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preparation method of spherical Ti3Al/TiAl two-phase alloy
CN102732748

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C22C-001/04 C22C-014/00
- **Publication Information**
CN102732748 A 2012-10-17 [CN102732748]
- **Priority Details**
2012CN-0264680 2012-07-27

- **Fampat family**

CN102732748	A	2012-10-17	[CN102732748]
CN102732748	B	2013-10-16	[CN102732748B]

- **Abstract:**
(CN102732748)
The invention provides a spherical Ti3Al/TiAl two-phase alloy and a preparation method thereof, relating to a two-phase alloy and a preparation method thereof. The invention aims to solve the problems of difficult control on TiAl alloy components, high oxygen content and impurity content and poor sintering performance. The spherical Ti3Al/TiAl two-phase alloy is composed of Ti and Al; and the mass ratio of Ti to Al is (65-68):(32-35). The preparation method of the spherical Ti3Al/TiAl two-phase alloy comprises the following steps: 1, weighing Ti powder and Al ingots, and impregnating at the impregnation temperature of 660-720 DEG C for 0.5-3 hours to obtain a Ti-Al-TiAl3 three-phase compound body; and 2, preserving the Ti-Al-TiAl3 three-phase compound body at the temperature of 1100-1400 DEG C and the pressure of 40-80 MPa for 0.5-2 hours to obtain the spherical Ti3Al/TiAl two-phase alloy. The density of the two-phase alloy is higher than 98%. The invention is applicable to the fieldsof aerospace engines and automobile industry.

Claims

(CN102732748)

1. A spherical Ti3Al/TiAl biphasic alloy, characterized in spherical Ti3Al/TiAl biphasic alloy is Ti and the Al composition by, wherein a mass ratio of Al and the Ti 65-68:32-35.

2. A spherical Ti3Al/TiAl biphasic alloy according to claim 1, characterized in Ti has a purity of 99.0%-99.9%, Al having a purity of 99.0%-99.9%.

3. A spherical Ti3Al/TiAl method for producing duplex alloys according to claim 1, characterized in one spherical Ti3Al/TiAl biphasic alloy was prepared in the following step is performed in: one, at a mass ratio of Al and the Ti 65-68:32-35 after mixing ratio of, placed in a vacuum hot press sintering furnace, being impregnated with the temperature of 660 °C -720 °C under conditions of, impregnated with 0.5-3h resulting Ti-Al-TiAl3 three-phase composite body; second, step two resulting Ti-Al-TiAl3 three-phase composite body placed in a vacuum hot press sintering furnace, sintering furnace temperature is raised to the vacuum thermode 1100 °C -1400 °C, pressurized to 40-80 mpa, incubated for 0.5-2h, with the furnace is then cooled, to give spherical Ti3Al/TiAl biphasic alloy.

4. A spherical Ti3Al/TiAl method for producing duplex alloys according to claim 3, characterized in step one Ti has a purity of 99.0%-99.9%, Al having a purity of 99.0%-99.9%.

5. A spherical Ti3Al/TiAl method for producing duplex alloys according to claim 3, characterized in Ti3Al/TiAl biphasic alloy volume percentage of 5-20 vol. %.

Casting titanium and titanium-aluminide alloy ceramic type backing layer paint and its preparation method

CN101099988

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- **International Patent Classification**
  B22C-003/00

- **Publication Information**
  CN101099988 A 2008-01-09 [CN101099988]

- **Priority Details**
  2007CN-0072602 2007-08-02

- **Fampat family**

CN101099988	A	2008-01-09	[CN101099988]
CN100455377	C	2009-01-28	[CN100455377C]

- **Abstract:**
  (CN101099988)
  The present invention relates to paint for casting titanium and titanium aluminum-base alloy cermet mold casing and its preparation process. The paint includes silica sol, bauxite powder, wetting agent JFC, defoaming agent n-octanol, high polymer and water emulsion. Its preparation process includes the following steps: stirring 15-25 wt% concentration silica sol in a stirring tank while adding high polymer and water emulsion slowly; 2. stirring the obtained jelly in a L-shaped stirring tank while adding the other materials gradually; and 3. letting stand in room temperature and 60-65 % humidity for 6-10 hr. The present invention may be applied widely in the making of titanium and titanium aluminum-base alloy cermet mold casing.

Claims

(CN101099988)

1. Cast titanium and titanium aluminum alloy of the ceramic shell of the back layer coating, which comprises a silica sol, bauxite powder, a wetting agent and an antifoaming agent JFC n-octanol, characterized in that it further comprises a polymer and water emulsion, wherein a particle size of 250 mesh bauxite powder-400 mesh, bauxite powder with silica sol having a pink liquid ratio of 2 g/ml-3.5 g/ml, the total mass of latex polymers and water with the silica sol was 0.01 wt %-0.04 wt %, by mass of silica sol wetting agent JFC to 0.02 wt %-0.06 wt %, anti-foaming agent to the silica sol by mass of n-octanol 0.02 wt %-0.05 wt %.
2. A back layer of the ceramic shell casting titanium and titanium aluminum alloy coating according to claim 1, characterized in, bauxite powder having a size of 325 mesh.
3. Titanium aluminum alloy of the ceramic shell casting titanium and a back layer coating according to claim 1, characterized in, polymer latex with the silica sol and water by mass of 0.01 wt %-0.02 wt %.
4. Titanium aluminum alloy of the ceramic shell casting titanium and a back layer coating according to claim 1, characterized in, polymer latex with the silica sol and water by mass of 0.02 wt %-0.04 wt %.
5. The ceramic shell casting titanium and titanium aluminum alloy consisting of backing layer coating according to claim 1, characterized in, polymer latex with the silica sol and water by mass of 0.015 wt % or 0.03 wt %.
6. Cast titanium and titanium aluminum alloy film is prepared by coating the back layer of the ceramic shell:
Step one: a concentration of 15%-35% silica sol was added with stirring in the mixing tube, and slowly added to polymers and water emulsions, micelles is ground to ensure that the silica sol, stirring jellied;
Step two: the step of a completion of the stirring of the L-type stirring tank were stirred into the gum, while gradually adding a defoaming agent n-octanol, wetting agent and the JFC bauxite powder, followed by stirring for 3 hours or more;
Step three: at a humidity of 60%-65% of the room temperature for 6-10 hours, to ensure complete wetting of all surfaces of the alumina refractory powder and gas to escape.
7. Titanium aluminum alloy cast titanium and method of manufacturing the ceramic shell of the back layer coating according to claim 6, characterized in, to the second step, stirred for 3 hours to 5 hours.
8. Titanium aluminum alloy cast titanium and method of manufacturing the ceramic shell of the back layer coating according to claim 6, characterized in, has a temperature of room temperature in a step three 22 °C -24 °C.
9. Titanium aluminum alloy cast titanium and method of manufacturing the ceramic shell of the back layer coating according to claim 6, characterized in, among in step one, using a rotational speed of 80r/min-90r/min with stirring, the stirring time is 20 minutes-40 minutes.
10. Cast titanium and titanium aluminum alloy of the ceramic shell of the back layer coating method of manufacture according to claim 6, characterized in, employed in the second step speed of 35r/min-40r/min rate of low-speed stirring.

Ti powder and Al alloy powder based on a complex powder of TiAl alloy method of preparing hot extruded semi-solid bar material

CN103725910

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- **International Patent Classification**
  C22C-001/04
- **Publication Information**
  CN103725910 A 2014-04-16 [CN103725910]
- **Priority Details**
  2014CN-0032233 2014-01-23

- **Fampat family**

CN103725910	A	2014-04-16	[CN103725910]
CN103725910	B	2016-02-10	[CN103725910B]

- **Abstract:**
  (CN103725910)
  The invention relates to a method for preparing a TiAl alloy bar through semisolid hot extrusion of composite powder based on Ti powder and Al alloy powder, relates to a preparation method of the TiAl alloy bar, and aims at solving the problems of many steps, overhigh energy consumption and too high expensive cost in the existing method for preparing the TiAl alloy. The method comprises steps of firstly, mixing the powder through ball milling with low energy; secondly, carrying out semisolid hot extrusion on composite powder of the Ti powder and the Al alloy powder, and directly reacting so as to synthesize the TiAl alloy bar. According to the method, firstly, the Ti powder and the Al alloy powder are uniformly mixed through ball milling with low energy, and then the Ti powder and the Al alloy powder react at low temperature through semisolid hot extrusion so as to synthesize the TiAl alloy and form the TiAl alloy bar. In the method, synthesis through reaction and deformation through extrusion are finished by one step; the method can be used for preparing compact and homogeneous TiAl alloy bar with low content of impurities, is easy in extrusion, has simple steps, consumes less energy, has light contamination and has low preparation cost.

Claims

(CN103725910)

1. Ti powder and Al alloy powder-based complex powder of TiAl alloy method of preparing hot extruded semi-solid rod, characterized in that it is carried out as follows:

One, low energy mix flour milling: using a particle size of 20-60 m of spherical Al alloy powder at a mass ratio of pure titanium particles and the powders 4-8:1, a rotational speed of 50-100r/min, mixed powder time was 4-8h conducted under conditions of low energy mix flour milling, Ti powder and Al alloy powder to obtain a composite powder, and then subjected to room temperature press to the vacuum envelope, the envelope blank is obtained;

Second, semi-solid hot extrusion: the step of a semi-solid billet is subjected to hot extrusion obtained by encapsulation of the deformation, TiAl alloy bar to give; wherein, extrusion ratio is 4-16:1, extrusion temperature between solidus temperature and the liquid line temperature between aluminum alloy.

2. Ti powder and Al alloy powder based on one of the TiAl alloy composite powder preparation method of semi-solid hot extruded rod according to claim 1, characterized in step one low energy milling conditions were: mass ratio of the powders 5-7:1, a rotational speed of 60-90r/min, mixed powder time was 5-7h.

3. Ti powder and Al alloy powder based on one of the TiAl alloy composite powder prepared semi-solid hot extrusion method of the rod according to claim 2, characterized in step one low energy milling conditions were: mass ratio of 6:1 to the powders, a rotational speed of 80r/min, mixed powder time of 6h.

4. Ti powder and Al alloy powder-based complex powder of TiAl alloy bar method of semi-solid hot extrusion was prepared according to claim 1, characterized in Al alloy powder is in the first step 2024Al 7075Al alloy powder or alloy powder.

5. Ti powder and Al alloy powder based on one of the TiAl alloy composite powder prepared semi-solid hot extrusion method of the rod according to claim 1, characterized in step two extrusion ratio of 5-14:1.

6. Ti powder and Al alloy powder based on one of the TiAl alloy composite powder prepared semi-solid hot extrusion method of the rod according to claim 5, characterized in step two extrusion ratio is 7-12:1.

7. Ti powder and Al alloy powder-based complex powder of TiAl alloy semi-solid hot extrusion method of preparing a rod according to claim 6, characterized in step two extrusion ratio is 9-10:1.

8. Ti powder and Al alloy powder based on a composite powder of the alloy bar stock is extruded semi-solid thermally TiAl method according to claim 7, characterized in step two extrusion ratio is 9:1.

9. Ti powder and Al-based alloy powder of the TiAl alloy composite powder prepared semi-solid hot extrusion method of the rod according to claim 1, characterized in step two extruded aluminum alloy having a solidus temperature in the range of higher than 10 °C liquidous temperature and less than 10 °C.

Al base composite material and method for rapidly preparing TiAl base composite material plate by utilizing same

CN103305725

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- **International Patent Classification**
  B32B-015/01 B32B-037/06 B32B-037/10 C22C-001/05 C22C-014/00 C22C-021/00 C22C-032/00
- **Publication Information**
  CN103305725 A 2013-09-18 [CN103305725]
- **Priority Details**
  2013CN-0169061 2013-05-09

- **Fampat family**

CN103305725	A	2013-09-18	[CN103305725]
CN103305725	B	2015-06-03	[CN103305725B]

- **Abstract:**
  (CN103305725)
  The invention relates to an Al base composite material and a method for rapidly preparing a TiAl base composite material plate by utilizing the same. The invention relates to a composite material and a method for preparing a plate by utilizing the same, which aim at solving the problem that the production cycle is too long due to the low reaction rate in the preparation of TiAl base alloy in the prior art. The Al base composite material is prepared from Al and a reinforcing body, or prepared from Al and an alloying element. The method comprises the steps of: 1. polishing; 2. cleaning; 3. hot pressing; and 4. annealing and densification treatment. According to the Al base composite material and the method, the reaction rate is high, the production cycle is short, the production process is easy and feasible, the cost is low, and the textile is small and controllable. The Al base composite material and the method are used for preparing the TiAl base composite material plate.

Claims

(CN103305725)

1. One Al-based composite material, characterized in one Al-based composite material, by a volume fraction 88%-99.9% of the Al and a 0.1%-12% of reinforcing a rotor braking mechanism; or an Al-based composite material according to quality score by 85%-99.9% of the Al and a 0.1%-15% made of alloy elements; wherein the reinforcement members is a SiC, B4C,TiB2,TiC and the Ti5Si3 one or a combination of several kinds, alloy elements are Ti, Si, one or more of B and a combination of Fe.
2. One Al-based composite material according to claim 1, characterized in Al of the particle diameter of 10 m -200 m, the reinforcement members have a diameter of 40 nm -10 m.
3. Using an Al-based composite material of the TiAl-based composite material plate according to rapid preparation method according to claim 1, characterized in TiAl-based composite material plate according to a method for rapid preparation, in particular of the prepared as follows:
One, in accordance with a pure Ti sheet and one Al-based composite material has a thickness ratio of 1.01-1.09: 1 according to claim 1, the pure Ti Al-based composite material is polished to a pure Ti plate and Al foil and based composite foil, wherein pure Ti foil has a thickness of 50 m -250 m;
Second, employ a volume concentration of 5%-20% HF solution of the pure Ti foil obtained by one cleaning steps, with a mass concentration of 5%-20% NaOH solution cleaning step one of the Al-based composite foil obtained, and the pure Ti foil and the Al-based composite foil ultrasonically cleaned in acetone and dried;
Three, pure Ti foil and the post-processing step two Al-based composite foil laminated alternatively placed, followed by hot-pressing process, control at temperatures of 350 °C -550 °C, a pressure of 20 mpa-50 mpa, temperature holding time of 1h-2h, to give the Ti-Al-based composite material sheet;
Four, the step three resulting Ti-Al-based composite material panel into the vacuum hot press furnace annealing reaction is carried out, controlling the temperature to 650 °C -800 °C, incubated 4h-10h, and then elevated to 1000 °C -1300 °C densification treatment is conducted, control densifaction process pressure of 20 mpa-100 mpa, holding for 0.5h-10h, and then at a temperature of 1300 °C -1400 °C incubated under conditions 10min-60min, TiAl-based composite material plate was obtained.
4. TiAl-based composite material plate according to the method of fast preparation according to claim 3, characterized in step one pure Ti plate and Al-based composite material of claim 1 A thickness ratio of 1.08: 1.
5. TiAl-based composite material plate according to the method of fast preparation according to claim 3, characterized in step two HF solution has a volume concentration of 10%-15%.
6. TiAl-based composite material plate according to a method for rapid preparation according to claim 3, characterized in step two NaOH solution mass concentration of 10%-15%.
7. TiAl-based composite material plate according to the method of fast preparation according to claim 3, characterized in step three the control at temperatures of 360 °C -540 °C, a pressure of 22 mpa-45 mpa.
8. TiAl-based composite material plate according to the method of fast preparation according to claim 3, characterized in pure Ti foil of layers is n + 1 in step three layers, the number of layers of the Al-based composite foil layer to n, wherein n is a positive integer, and the n 1.
9. TiAl-based composite material plate according to the method of fast preparation according to claim 3, characterized in step four control densifaction process pressure of 22 mpa-98 mpa, temperature holding time of 0.7h-9.8h.
10. TiAl-based composite material plate according to the method of fast preparation according to claim 9, characterized in step four control densifaction process pressure of 30 mpa-90 mpa, temperature holding time of 1h-9h.

Method for diffusely connecting TiAl-based alloy and Ti3AlC2 ceramic by adopting Zr/Ni composite intermediate layer

CN103204694

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- **International Patent Classification**
  C04B-037/02
- **Publication Information**
  CN103204694 A 2013-07-17 [CN103204694]
- **Priority Details**
  2013CN-0115208 2013-04-03

- **Fampat family**

CN103204694	A	2013-07-17	[CN103204694]
CN103204694	B	2014-04-02	[CN103204694B]

- **Abstract:**
  (CN103204694)
  The invention relates to a method for diffusely connecting a TiAl -based alloy and a Ti3AlC2 ceramic by adopting a Zr/Ni composite intermediate layer, and relates to a method for connecting the TiAl-based alloy and the Ti3AlC2 ceramic. The method solves the problem that the TiAl-based alloy and the Ti3AlC2 ceramic are difficult to connect. The method comprises the following steps of: 1, cutting; 2, burnishing, polishing and cleaning; 3, assembling the assembly part of the TiAl-based alloy/Zr foil/Ni foil/Ti3AlC2 ceramic; and 4, completing the diffusion connection of the TiAl-based alloy and the Ti3AlC2 ceramic by adopting the Zr/Ni composite intermediate layer. The method disclosed by the invention successfully realizes the connection of the TiAl-based alloy and the Ti3AlC2 ceramic, obtains a reliable connector with room-temperature shear strength maximally achieving 103.6 MPa and is used for diffusely connecting the TiAl-based alloy and the Ti3AlC2 ceramic by adopting the Zr/Ni composite intermediate layer.

Claims
(CN103204694)
1. A process using a TiAl-based alloy and a Zr/Ni composite interlayer diffusion bonding Ti3AlC2 method of ceramics, characterized in a process using a Zr/Ni composite intermediate layer TiAl-based alloy and the diffusion bonded sputtering Ti3AlC2 method of ceramics, in particular in accordance with the following steps completed:
One, and the TiAl-based alloys and Ti3AlC2 ceramic with a wire-cut, and the TiAl-based alloy to be joined is obtained Ti3AlC2 ceramic;
Second, the step of a TiAl based alloy and connected to get from the Ti3AlC2 connecting surfaces of the ceramic after polishing using sandpaper, and the TiAl-based alloys and Ti3AlC2 connecting surfaces of the ceramic ultrasonic cleaning in acetone was placed 5min-10min;
Three, Zr foil and the Ni foil is placed to be connected to the TiAl-based alloys and Ti3AlC2 between connecting surfaces of the ceramic, TiAl-based alloy/Ni/Zr foil to assemble into a foil/Ti3AlC2 assembly of ceramic, wherein the Zr foil has a thickness of 25 m -150 m, Ni foil has a thickness of 25 m -150 m;
Four, the resulting assembly is placed in the step three vacuum oven, applying 20 mpa-40 mpa pressure, vacuum level is reached when the vacuum heating furnace (1.3-2.0) x10-3Pa time, conduction heating, control heating rate of 20 °C/min-40 °C/min, temperature was raised to 800 °C -900 °C, followed by incubation for 30min-120min, and further controls the cooling rate of 5 °C/min-10 °C/min, cooled to 300 °C, and then with furnace cooling, to be carried out using TiAl-based alloy and a Zr/Ni composite interlayer diffusion bonding Ti3AlC2 method of ceramic.
2. A process using a TiAl-based alloy and a Zr/Ni composite interlayer diffusion bonding Ti3AlC2 method of ceramics according to claim 1, characterized in step three the Zr foil has a thickness of 50 m -100 m, Ni foil has a thickness of 50 m -100 m.
3. A process using a TiAl-based alloy and a Zr/Ni composite interlayer diffusion bonding Ti3AlC2 ceramic method according to claim 2, characterized in Zr foil has a thickness of 80 m in step three, Ni foil has a thickness of 80 m.
4. A process using a TiAl-based alloy and a Zr/Ni composite interlayer diffusion bonding Ti3AlC2 method of ceramics according to claim 1, characterized in step four applied pressure of 30 mpa.
5. A process using a TiAl-based alloy and a Zr/Ni composite interlayer diffusion bonding Ti3AlC2 method of ceramics according to claim 1, characterized in step four vacuum furnace vacuum level is reached 1.5x10-3Pa.
6. A process using a TiAl-based alloy and a Zr/Ni composite interlayer diffusion bonding Ti3AlC2 method of ceramics according to claim 1, characterized in step four control heating rate of 30 °C/min.
7. A process using a Zr/Ni composite intermediate layer TiAl-based alloy and the diffusion bonded sputtering Ti3AlC2 method of ceramics according to claim 1, characterized in step four fiber was heated at 850 °C.
8. A process using a TiAl-based alloy and a Zr/Ni composite interlayer diffusion bonding Ti3AlC2 ceramic method according to claim 1, characterized in step four insulation 50min-100min.
9. A process using a TiAl-based alloy and a Zr/Ni composite interlayer diffusion bonding Ti3AlC2 method of ceramics according to claim 8, characterized in step four insulation 60min.
10. A process using a TiAl-based alloy and a Zr/Ni composite interlayer diffusion bonding Ti3AlC2 method of ceramics according to claim 1, characterized in step four cooling rate of 8 °C/min.

Based on the elemental Ti powder and powder preparation method of the intermetallic compound parts TiAl Al elements

CN103143709

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  B22F-003/16 C22C-001/04 C22C-014/00 C22C-021/00

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- **Publication Information**
  CN103143709 A 2013-06-12 [CN103143709]
- **Priority Details**
  2013CN-0099463 2013-03-26

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- **Fampat family**

CN103143709	A	2013-06-12	[CN103143709]
CN103143709	B	2014-10-29	[CN103143709B]

- **Abstract:**
  (CN103143709)
  A method for manufacturing TiAl intermetallic compound component based on Ti elemental powders and Al elemental powders relates to a method for manufacturing a TiAl intermetallic compound component, and belongs to the technical field of metal component precise forging and forming processes. By adopting a novel technological process based on Ti/Al elemental powder forging and subsequent reactive sintering, the invention aims to solve the problems of great forming difficulty, being difficult for existing mould materials to satisfy process requirements, high process cost and huge energy consumption in the manufacturing process of the TiAl intermetallic compound component by the traditional isothermal forging method. The method comprises the steps of: I, mixing powders; II, manufacturing Ti/Al powder preforms; III, precisely mould-forging and forming Ti/Al powder body under low temperature; IV, reactively sintering forged Ti/Al powder pieces; and V, repressing and reshaping under high temperature to obtain the TiAl intermetallic compound component. The invention mainly utilizes the Ti elemental powders and Al elemental powders to manufacture the TiAl intermetallic compound component.

Claims

(CN103143709)

1. Based on Ti Al intermetallic compound TiAl element powder and elemental powders prepared method of parts thereof, characterized in Ti-based intermetallic compound TiAl powder and Al powder prepared element elements are achieved by the steps of the method of parts thereof:

One, mixed powder: first the elements Ti powder, Al powder evenly mixed element powder and R elements, to obtain a mixed powder; Ti with Al in the mixed powder in a first step of the atomic percentage of elements as elements (0.85-1.25): 1; step one mixed powder percentage is less than 10% atom of an element R;

Second, Ti/Al powder preform production: in the compressive stress of 800 mpa-1000 mpa for press-molding a mixed powder obtained in the first step, the preform obtained Ti/Al powder;

Three, die-molding a precision low temperature Ti/Al powder: in the compressive stress of 1000 mpa-1200 mpa and a temperature of 20 °C -500 °C under conditions Ti/Al powder obtained by the second step by die-molding the preform is precision, Ti/Al powder forging was obtained;

Four, Ti/Al powder forging reaction sintering: at a temperature of 1100 °C -1250 °C under the Ti/Al powder forging obtained by a sintering process step three, TiAl intermetallic compound to obtain a crude tissue parts thereof;

Five, high-temperature recovers orthopedic: TiAl intermetallic compound in accordance with step four are first obtained crude tissue parts thereof heated to 1100 °C -1250 °C, then place orthopedic cavity is a compressive stress to 300 mpa-500 mpa to high -temperature recovers orthopedic, TiAl intermetallic compound parts thereof is obtained.

2. Based on Ti Al intermetallic compound TiAl element powder and a method of preparing elemental powders parts thereof according to claim 1, characterized in step one R element powder is elemental powders Ti, Al element powder, Nb powder elements, Cr element powder, W powder elements, the elements Mo powder, Ta powder element, Zr element powder, Y powder element, Si powder and B powder elements of one or several of which mixture elements.

3. Based on Ti Al intermetallic compound TiAl element powder and method of elemental powders prepared parts thereof according to claim 1 or 2, characterized in step one of the high-Ti elemental powders to the mixed powder, Al powder and R element powder are mixed elements.

4. Based on Ti Al intermetallic compound TiAl element powder and a method of preparing elemental powders parts thereof according to claim 1 or 2, characterized in step one of the elemental powders using a ball mill for Ti, Al element powder and R element powder were mixed.

5. Based on Ti Al intermetallic compound TiAl element powder and elemental powders prepared parts thereof of the method according to claim 1, characterized in step two in the compressive stress of 800 mpa-1000 mpa a mixed powder obtained in the first step is carried out under pressing a steel mold, and then at a temperature of less than 500 °C under low temperature vacuum sintering, low-temperature vacuum sintering time of 1h-3h, Ti/Al powder preform is obtained.

6. Based on Ti Al intermetallic compound TiAl element powder and method of elemental powders prepared parts thereof according to claim 1, characterized in step two in the first step at a temperature of less than 500 °C conditions a mixed powder obtained was vacuum hot pressing, vacuum hot press forming time of 1h-3h, Ti/Al powder preform is obtained.

7. Based on Ti Al intermetallic compound TiAl element powder and elemental powders prepared parts thereof of the method according to claim 1, characterized in step three the precision die-molding is carried out in an inert gas protection and a vacuum environment.

8. Based on Ti Al intermetallic compound TiAl element powder and elemental powders method of preparing parts thereof according to claim 1, characterized in step four sintering process is a vacuum heat pressing reaction sintering process.

Method for producing oxide ceramic shell capable of improving TiAl alloy casting surface performances

CN102873273

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  B22C-001/00 B22C-001/18 B22C-003/00 B22C-009/04
- **Publication Information**
  CN102873273 A 2013-01-16 [CN102873273]
- **Priority Details**
  2012CN-0420890 2012-10-29

- **Fampat family**

CN102873273	A	2013-01-16	[CN102873273]
CN102873273	B	2014-03-05	[CN102873273B]

- **Abstract:**
  (CN102873273)
  A method for producing an oxide ceramic shell capable of improving TiAl alloy casting surface performances relates to a method for producing an oxide ceramic shell. The invention aims to solve the defect that a TiAl alloy casting surface does not have enough oxidation resistance, and provides the method for producing the oxide ceramic shell capable of improving the TiAl alloy casting surface performances. The method comprises: 1. surface layer coating production; 2. surface layer shell production; 3. adjacent surface layer shell production; 4. back layer shell production; and 5. shell dewaxing and calcinating, so that the production of the oxide ceramic shell capable of improving the TiAl alloy casting surface performances is completed. The method is applied to the field of producing the oxide ceramic shell capable of improving the TiAl alloy casting surface performances.

Claims
(CN102873273)
1. A method for improving the surface properties of the oxide of the ceramic shell casting TiAl alloy production method, characterized in improving the surface properties of the oxide of the ceramic shell casting TiAl alloy prepared by the following steps implemented method:
One: preparation of paint top ply: at 100-300r/min rate of stirring, a defoamer was added to the binder and wetting agent, and then the mass of the binder volume ratio of the oxide powder (2.0-3.8) g: 1mL oxide powder was added to the binder, while being stirred, mixed and prepared as a coating, and then at 100-200r/min rate of stirring, the coating oxide powder with the addition of material in a mass ratio of (0.1-20): 100 added to the paint additive material, uniformly mixing the mixture was allowed to stand, thereby completing preparation of paint layer; wherein, adhesive is a zirconia sol, defoamer is n-octanol, a wetting agent is a fatty alcohol polyoxyethylene ether JFC, anti-foaming agent and a binder on a mass ratio of (0.01-0.5): 100, a wetting agent and a binder on a mass ratio of (0.01-0.5): 100, oxide powder of zirconium oxide or yttrium oxide, particle size of 270-320 mesh, additive material is elemental, oxide or compounds of one or several of these, wherein, a simple substance of silicon, niobium, chromium, molybdenum, tungsten, one of yttrium and zirconium, oxide composed of silicon oxide, niobium oxide, chromium oxide, molybdenum oxide, tungsten oxide, yttrium oxide and zirconium oxide one, compound is a niobium-containing compounds, chromium compounds, molybdenum compounds, tungsten compounds, one of the yttrium compound and a zirconium compound;
Second, sheet-type shell was prepared: at 100-200r/min under the stirring speed in step one of the top layer coating formulation was stirred for 1-4h rear, adjusting the viscosity of the coating to the top ply 90s, and then the wax pattern is immersed in the coating layer, top layer coating to be lifted from a wax, a wax model of the zirconia sand spread out evenly over the surface, at a humidity of 30-70%, thermostat 18-30 °C is dried under an environment 8-24 hours, thereby completing the preparation of molds a facing sheet;
Third, temporary preparation of the shell-type top ply: at 100-200r/min under the stirring speed in step one of the top layer coating formulation was stirred for 1-4h rear, adjusting the viscosity of the coating to the top ply 80s, prepared in step two in the top ply top layer coating is dipped into molds, and then lifted from the mold-top ply top layer coating, the zirconia sand spread out evenly over the upper mold-facing layer, and then at a humidity of 30-70%, thermostat 18-30 °C is dried under an environment 8-24 hours, thereby completing the preparation of molds of a temporary layer;
Four, back-layered shell was prepared: by pink liquid ratio of (2-3.5) of the mullite powder and silica sol is prepared by mixing g: 1mL out of the back layer coating, the dorsal layer viscosity of the coating, and then steps to a backing prepared in the third shell is immersed in the temporary coating in the surface type, surface type housing from the back layer coating the temporary raised, spread out evenly over the surface of the mullite wax model, and then at a humidity of 30-70%, thermostat 18-30 °C is dried under an environment 8-24 hours, thereby completing preparation of a back-layered shell;
Five, the deparaffinization and the fired molds: completely dried in step four to a back-layered shell is subjected to steam dewaxing, will complete deparaffinization a shell is fired, the oven was prepared as a mold that is formed after the cooling completion of the TiAl alloy casting surface of the oxide of the ceramic shell to improve performance of the preparation.
2. A method for improving the surface properties of the ceramic shell casting TiAl alloy oxide production method according to claim 1, characterized in step one uniformly mixing the mixture to stand for 8-12h.
3. A method for improving the surface properties of the ceramic shell casting TiAl alloy oxide production method according to claim 1, characterized in step one in the top layer coating formulation has a viscosity of 80-90s.
4. A method for improving the surface properties of the TiAl alloy casting process for the preparation of the ceramic shell oxide according to claim 1, characterized in step four back layer coating has a viscosity of 35-40s.
5. A method for improving the surface properties of the ceramic shell casting TiAl alloy oxide production method according to claim 1, characterized in step four mullite powder particle size of 320 mesh.
6. TiAl alloy casting an oxide of a method for improving the surface properties of the ceramic shell production method according to claim 1, characterized in step five the steam dewaxing of the steam pressure of 0.5-0.7 mpa, dewaxing time was 5-15 minutes.
7. A method for improving the surface properties of the oxide of the ceramic shell casting TiAl alloy production method according to claim 1, characterized in step five the baking temperature was raised to as first 200-400 °C, incubated for 30-60 minutes, then ramping to 800-1100 °C, the firing time is 0.5-3 hours.

Continuous Mo fiber reinforcement TiAl base composite material and method for preparing same

CN102796972

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- **International Patent Classification**
  C22C-047/14 C22C-049/11 C22C-111/02

- **Publication Information**
  CN102796972 A 2012-11-28 [CN102796972]
- **Priority Details**
  2012CN-0336377 2012-09-12

- **Fampat family**

CN102796972	A	2012-11-28	[CN102796972]
CN102796972	B	2014-01-15	[CN102796972B]

- **Abstract:**
  (CN102796972)
  The invention provides a method for preparing the continuous Mo fiber reinforcement TiAl base composite material, relates to a composite material and a method for preparing the composite material, and are mainly used for solving the problems that the existing TiAl alloy has brittleness at room temperature and insufficient strength at high temperature and the method for preparing the existing continuous Mo fiber reinforcement TiAl base composite material is complicated, and has low efficiency and high cost. The continuous Mo fiber reinforcement TiAl base composite material consists of a continuous Mo fiber reinforcement and a TiAl base body. The method for preparing the continuous Mo fiber reinforcement TiAl base composite material comprises the following steps of: firstly, preparing powder slurry; then, preparing a precast body by adopting the powder slurry casting method, and cutting the precast body; and finally, carrying out vacuum hot-pressing sintering, and thus obtaining the continuous Mo fiber reinforcement TiAl base composite material. The prepared composite material has good toughness at room temperature and high strength at high temperature, and the method for preparing the composite material is simple, has high efficiency and is low in cost. The method is suitable for producing the continuous Mo fiber reinforcement TiAl base composite material.

Claims

(CN102796972)

1. A continuous fiber-reinforced Mo TiAl-based composite material, characterized in Mo TiAl-based composite material formed from a continuous fiber-reinforced continuous fiber-reinforced plastic matrix having TiAl phase and Mo; wherein, Mo percent by volume of fibers 10-50 vol.%; Ti with Al in the TiAl matrix elements in a molar ratio of the element 1-1.5: 1.

2. A continuous process for preparing TiAl-based composite material fiber-reinforced Mo according to claim 1, characterized in continuous process for preparing TiAl-based composite material fiber-reinforced Mo was done as follows:

One, 1 parts by mass was weighed parts of polymethyl methacrylate, 4-10 parts by weight of Ti powder and Al powder were combined; wherein, the molar ratio of Ti powder and Al powder 1-1.5: 1;

Second, the step of a polymethyl methacrylate was added to acetone is weighed, and dissolved with stirring, preparing polymethylmethacrylate by weight solution in an amount of 15.3%-20.2% acetone solution of polymethyl methacrylate, then adding Ti powder and Al powder weighed step one of the stirring continued until a homogeneous suspension of the mixed powder, to obtain a powder slurry;

Three, with the fiber winding machine, as a carrier to an aluminum plate, and the fibers to be Mo 0.12-0.3 mm pitch of the aluminum sheet was wound, will be derived over which the powder slurry coating step, coating with a thickness of 0.24-0.6 mm, natural circumstances, volatilize acetone powder in the slurry to be, powder slurry is solidified, to obtain an aluminum plate covered with composite material preform; wherein, Mo fiber has a diameter of 0.08-0.18 mm;

Four, at step three resulting coated with a composite material of an aluminum plate as a carrier preform, in a three-step method of operation is repeated 10-40 times, which is then cut, to separate the aluminum plate and composite material precursor, to obtain a composite material preform;; wherein, the volume percent of fiber composite preform Mo 5-25 vol.%;

Fifth, hot press-sintering method, in a vacuum hot press sintering furnace, a graphite mold, the step four of the resulting composites sintered preform was done as follows: a, obtained by the step four composite material preform at a pressure of 5-10 mpa conditions, from room temperature to 360-390 °C, and is held under this condition 0.8-2h; b, increasing the pressure to 20-40 mpa, temperature was raised to 680-720 °C, and in this condition hold 10-40min; c, holding pressure was increased to 1000-1200 °C, and is held under this condition 1-4h; d, of the oven was cooled to room temperature, TiAl-based composite material to obtain a continuous fiber-reinforced Mo; wherein, hot press sintering process to a vacuum of 10-2Pa, heating rate of 8-15 °C/min.

3. A continuous process for preparing TiAl-based composite material fiber-reinforced Mo according to claim 2, characterized in parts by mass was weighed out in step one 1 parts of polymethyl methacrylate, 6 parts of a mixed powder of Ti powder and Al powder; wherein, the molar ratio of Ti powder and Al powder 53:47.

4. A continuous process for preparing TiAl-based composite material fiber-reinforced Mo according to claim 2, characterized in prepared in step two 17.4% by weight solution of methyl methacrylate is a polymethyl methacrylate as acetone solution.

5. A continuous process for preparing TiAl-based composite material fiber-reinforced Mo according to claim 2, characterized in step three will be Mo 0.2 mm spacing of the fibers to be wound around the aluminum plate.

6. TiAl-based composite material Mo a continuous process for producing fiber-reinforced according to claim 2, characterized in step three is applied in a thickness of 0.4 mm.

7. A continuous fiber-reinforced composite material of the TiAl based Mo production method according to claim 2, characterized in step five percent of a step at a pressure of 8 mpa from room temperature to 380 °C under the condition that, under conditions where it is held 1h.

8. A continuous process for preparing TiAl-based composite material fiber-reinforced Mo according to claim 2, characterized in step five of the step b to increase the pressure to 30 mpa, temperature was raised to 700 °C, and in this condition remains 30min.

9. A continuous process for preparing TiAl-based composite material fiber-reinforced Mo according to claim 2, characterized in step c temperature was raised to 1100 °C and a fifth step of the pressure is maintained, and when the conditions hold 2h.

10. According to claim 2, 7, 8 or 9 a continuous process for preparing TiAl-based composite material fiber-reinforced Mo, characterized in step five the heating rate of 10 °C/min.

Preparation method of TiAl-based laminar composite material plate CN102729575

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- **International Patent Classification**
  B22F-003/03 B32B-015/01 B32B-015/20 B32B-037/06

- **Publication Information**
  CN102729575 A 2012-10-17 [CN102729575]

- **Priority Details**
  2012CN-0259750 2012-07-25

- **Fampat family**

CN102729575	A	2012-10-17	[CN102729575]
CN102729575	B	2014-08-13	[CN102729575B]

- **Abstract:**
  (CN102729575)
  The invention discloses a preparation method of a TiAl-based laminar composite material plate, which is used for solving the problems of poor tissue compactness and poor tissue uniformity existing in the conventional TiAl-based material. The method comprises the following steps of: performing ball milling and powder mixing on reinforced bodied and Ti powder, and performing hot pressed sintering, linear cutting and surface pretreatment to obtain a TiB/Ti composite plate on which reinforced bodies are distributed continuously; performing surface treatment on the TiB/Ti composite plate and a pure Al plate, and performing laminating and hot pressing alternatively; and performing thermal treatment to perform a diffusion reaction on the Ti plate and the Al plate to obtain a TiAl-based laminar composite material plate. The TiAl-based laminar composite material plate disclosed by the invention can be used for preparing parts of aviation or space flight engines or wings or shell of ultrahigh-speed flying vehicles and preformed materials formed in a super plasticizing way.

Claims
(CN102729575)
1. One method for producing TiAl grass-like composite panels, characterized in TiAl grass-like method for preparing composite panels as defined in the following steps:
One, will enhance the mass ratio of 5:1 with a Ti-powder inulins in body, a rotational speed of 180-200rmp milling under conditions of 7-10h, to obtain a mixed powder, wherein the reinforcement members are TiB_2, increase the quality of the mixed powder Reinforcement 3%-5%;
Second, the resulting mixed powder was put into a mold will be in the first step, and the mold in a heated oven, at a temperature of 1200-1300 °C, a pressure of 25-30 mpa hot-pressed under conditions of 1-1.5h, to obtain heat spindles, the thermo-compression wire-cut ingot into slabs, and then surface after pretreatment, the resulting TiB/Ti composite panel;
Three, goes through the pre-processed surface of the Al plate, and the step will be derived alternately put in layers in a heated oven TiB/Ti composite panel, first at a temperature of 515-520 °C, a pressure of 25-35 mpa precompressed under the condition that 1.5-2h, and then the pressure was reduced to 0 mpa, was heated to 660 °C -670 °C and held for 2-3h, followed by warming to 800 °C holding 2-3h, and then elevated to 1200 °C holding 3-6 h, finally cooled down to 1000-1100 °C, while applying pressure to 25-35 mpa, hold 30-50min, TiAl grass-like composite material sheet was obtained.
2. Claim 1 TiAl grass-like method for preparing composite panels as described, characterized in step two surface pretreatment to: 10 vol.% HF solution were washed and thinned to a thickness in the design, and then the surface grinding, a tool mark and the etching layer is removed.
3. Claim 1 or 2 TiAl as grass-like method for producing composite panels, characterized in step three the pre-processing to the surface of the Al plate: Al plate with 600 mesh or 800 purpose sanding, and then washed with 10 wt.% NaOH alkaline cleaning.
4. Claim 1 TiAl grass-like as process for preparing composite panels, characterized in step three the Al plate has a thickness of 0.1 mm.
5. Claim 1 TiAl grass-like as process for preparing composite panels, characterized in step three the TiB/Ti composite panel has a thickness of 0.3-0.6 mm.
6. Claim 1 TiAl grass-like method for preparing composite panels as described, characterized in step three the TiB/Ti composite panel is placed with the Al plate are alternately stacked, uppermost and lowermost ends to TiB/Ti composite panel.
7. Claim 1 TiAl grass-like method as the preparation of composite panels, characterized in step three the Al plate is placed with the TiB/Ti stacked alternately one composite panel, Al plate of layers is 5 layers, 6 layers is a layer of TiB/Ti composite panel.

Preparation method of TiAl base alloy plate
CN102626713

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- **International Patent Classification**
  B21B-001/38 B21B-047/00 C22F-001/00 C22F-001/02 C22F-001/04 C22F-001/18
- **Publication Information**
  CN102626713 A 2012-08-08 [CN102626713]
- **Priority Details**
  2012CN-0097545 2012-04-05

- **Fampat family**

CN102626713	A	2012-08-08	[CN102626713]
CN102626713	B	2013-11-20	[CN102626713B]

- **Abstract:**
  (CN102626713)
  The invention discloses a preparation method of a TiAl base alloy plate, relates to a preparation method of an alloy plate, and aims to solve the technical problem of long production period existing in the conventional method for preparing the TiAl base alloy plate. The method comprises the following steps of: 1, performing surface treatment on Ti foils and Al foils and then alternately laminating, wrapping with the Ti foil, placing in a graphite mould and placing the graphite mould in a vacuum hot pressing sintering furnace; and 2, after vacuuming the vacuum hot pressing sintering furnace, heating to 400-600 DEG C and applying pressure of 10-30 MPa to press for 0.5-1 hour, decompressing to 0 MPa, continuously heating to 900-1,300 DEG C and keeping for 2-6 hours, and finally keeping for 0.5-1 hour under the conditions of 900-1,300 DEG C and pressure of 30-50 MPa and cooling to obtain the TiAl base alloy plate. According to the method, the Ti foils and the Al foils are subjected to solid-liquid reaction, so that the preparation period is shortened. The method is used for preparing the alloy plate.

Claims

(CN102626713)

1. One method for producing TiAl-based alloy sheets, characterized in TiAl-based alloy plate material was prepared in the following step is performed in:

One, Ti foil and the Al foil after the surface treatment will be put in layers alternately, and the Ti foil wrap, and placed in a graphite mold, placed in a vacuum hot press sintering graphite die was then oven;

Second, the vacuum hot press sintering furnace chamber was evacuated to 1x10-3Pa-9x10-3Pa, then warmed, when the temperature was raised to 400-600 °C is applied 10-30 mpa pressing pressure of 0.5-1h; subsequently releasing the pressure to 0 mpa, further increasing the temperature to 900-1300 °C and held for 2-6h; finally at 900-1300 °C, a pressure of 30-50 mpa Torr for 0.5-1h, after cooling of the oven, TiAl-based alloy plate material was obtained.

2. One method for producing TiAl-based alloy sheet according to claim 1, characterized in Ti foil has a thickness of from Step One were 50-200 m.

3. TiAl-based alloy sheet production method according to one according to claim 1 or 2, characterized in Al foil has a thickness of from Step One were 50-200 m.

4. One method for producing TiAl-based alloy sheet according to claim 1 or 2, characterized in step a surface treatment is a Ti foil and the Al foil with an organic solvent wipe surface, and the Ti foil by acid cleaning, alkali cleaning of the Al foil.

5. One method for producing TiAl-based alloy sheet according to claim 4, characterized in surface treatment of the used organic solvent is acetone, ethanol or methanol.

6. One method for producing TiAl-based alloy sheet according to claim 4, characterized in Ti foil was immersed in an acid - treated surface is the mass concentration of 5%-10% HF aqueous solution of the soaking 10-30s, and then washed with clean water, blown dry.

7. One method for producing TiAl-based alloy sheet according to claim 4, characterized in Al foil was immersed in the surface-treated base is a mass concentration of 5%-20% of the NaOH solution for 10-30s, and then washed with clean water, blown dry.

8. One method for producing TiAl-based alloy sheet according to claim 1 or 2, characterized in step one alternate laminations of the total layer number of 11-31 layer.

9. TiAl-based alloy sheet production method according to one according to claim 1 or 2, characterized in step one with Ti foil wrap post, Ti foil outer surface coated with a layer in the BN or Y_2O_3.

Preparation method of three-dimensional network distributed Ti2AlN particle reinforced TiAl-based composite material

CN102418000

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- **International Patent Classification**
  C22C-001/05 C22C-032/00
- **Publication Information**
  CN102418000 A 2012-04-18 [CN102418000]
- **Priority Details**
  2011CN-0417995 2011-12-14

- **Fampat family**

CN102418000	A	2012-04-18	[CN102418000]
CN102418000	B	2013-03-13	[CN102418000B]

- **Abstract:**
  (CN102418000)
  The invention discloses a three-dimensional network distributed Ti2AlN particle reinforced TiAl-based composite material and a preparation method thereof, and relates to a Ti2AlN particle reinforced TiAl-based composite material and a preparation method thereof. The composite material consists of a Ti2AlN particle reinforcing phase and a TiAl matrix, wherein Ti2AlN particles are distributed in the TiAl matrix in a three-dimensional network shape. The method comprises the following steps of: performing nitriding treatment on titanium powder to obtain nitrided titanium powder, performing hot pressing and sintering on the mixture of the nitrided titanium powder and aluminum powder, and thus obtaining the composite material. The structure of the TiAl matrix is thinned, and the reinforcing phase Ti2AlN particles are distributed in the TiAl matrix in the three-dimensional network shape and encircle the TiAl crystal colonies to form a structure which is more stable than a single TiAl alloy. The composite material has higher structural thermal stability and good long-time service performance under the high -temperature condition, the high-temperature compression strength of the composite material is improved, and the compression strength of the composite material at the temperature of 900 DEG C reaches 958.9MPa.

Claims

(CN102418000)

1. A three-dimensional net-like distribution of Ti2AlN particle-enhanced TiAl-based composite material, characterized in three-dimensional net-like distribution of Ti2AlN TiAl-based composite material is a particulate reinforced Ti2AlN TiAl phase and particle-reinforced plastic matrix having, wherein Ti2AlN particles were in a three-dimensional net-like distributed in the TiAl matrix.
2. A three-dimensional net-like distribution of Ti2AlN TiAl-based composite material of the particle-enhanced production method according to claim 1, characterized in three-dimensional net-like distribution of Ti2AlN TiAl-based composite material of the reinforcing particles is prepared by following steps: one, in a flowing nitrogen atmosphere, heated to a temperature of the titanium powder 500 °C -600 °C, and retained for nitrided 12-48 hours, resulting nitrided titanium powder; second, nitrided titanium powder and aluminum powder at a mass ratio of 48:16-27 nitrided titanium powder and aluminum powder were weighed ratio of, nitrided titanium powder and aluminum powder mixed and then added by weighing after milling mixing the liquid dispersant 5-20h, resulting wet blend, and the wet mixing dried obtaining a mixed powder; three, step two after cold press forming a mixed powder obtained was placed in a graphite mold, and the graphite mold into a hot press sintering furnace hot press firing three-dimensional net-like distribution of the obtained Ti2AlN TiAl-based composite material reinforced particles, wherein hot press sintering process is: from room temperature to 600 °C -800 °C, and then pressurized to 20-60 mpa, heat-retaining packing 1-4 hours, and then elevated to 1250 °C -1350 °C, heat-retaining packing 0.5-2 hours later, the pressure is unloaded, and then elevated to 1380 °C -1450 °C, incubated for 0.5 hours, again as cooled furnace.
3. A three-dimensional net-like distribution of Ti2AlN particle enhanced method for producing TiAl-based composite material according to claim 2, characterized in step one in a flowing nitrogen atmosphere, titanium powder was heated to 600 °C, and retained for nitrided 24 hours, nitrided titanium powder obtained.
4. A three-dimensional net-like distribution of Ti2AlN method for producing TiAl-based composite material reinforced particles according to claim 2 or 3, characterized in step one is in an atmosphere of nitrogen flow 400-600 ml/min flow rate of gas flow.
5. A three-dimensional net-like distribution of Ti2AlN TiAl-based composite material of the particle-enhanced production method according to claim 2 or 3, characterized in nitrided titanium powder and aluminum powder in step two at a mass ratio of titanium powder and aluminum powder were weighed 48:20 .25 ratio of nitrided.
6. A three-dimensional net-like distribution of Ti2AlN TiAl-based composite material of the particle-enhanced production method according to claim 2 or 3, characterized in step two of the specific parameter is a milling mixing: mass ratio of 5:1 to the powders, a rotational speed of 100-150r/min, a mixing time of 5-20 hours.
7. A three-dimensional net-like distribution of Ti2AlN TiAl-based composite material of the particle-enhanced production method according to claim 2 or 3, characterized in step three the hot press sintering process is: from room temperature to 650 °C -750 °C, and then pressurized to 30-50 mpa, heat-retaining packing 1.5-3 hours, and then elevated to 1280 °C -1320 °C, heat-retaining packing 0.8-1.5 hours later, the pressure is unloaded, and then elevated to 1380 °C -1400 °C, incubated for 0.5 hours, again as cooled furnace.
8. A three-dimensional net-like distribution of Ti2AlN TiAl-based composite material of the particle-enhanced production method according to claim 2 or 3, characterized in step three the hot press sintering process is: from room temperature to 700 °C, and then pressurized to 40 mpa, incubated for 2 hours dwell, and then elevated to 1300 °C, after 1 hour incubation of the holding pressure, the pressure is unloaded, and then elevated to 1380 °C, incubated for 0.5 hours, again as cooled furnace.
9. A three-dimensional net-like distribution of Ti2AlN TiAl-based composite material of the particle-enhanced production method according to claim 2 or 3, characterized in step three the hot press sintering process temperature raising process of controlling a heating rate of 5-15 °C/minute.

Preparation method of reticular Ti5Si3 and dispersed TiC enhanced TiAl-based composite

CN102134662

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  C22C-001/05 C22C-001/10
- **Publication Information**
  CN102134662 A 2011-07-27 [CN102134662]
- **Priority Details**
  2011CN-0003733 2011-01-10

- **Fampat family**

CN102134662	A	2011-07-27	[CN102134662]
CN102134662	B	2012-05-23	[CN102134662B]

- **Abstract:**
  (CN102134662)
  A preparation method of a reticular Ti5Si3 and dispersed TiC enhanced TiAl-based composite relates to the preparation method of the TiAl-based composite. The invention aims to solve the problems that the oxidation resistance of the TiAl alloy is poor above 800 DEG C and the preparation process of the high density TiAl alloy is complicated. The method comprises the following steps: 1) preparing the mixed powder of Ti and SiC; 2) performing pressure infiltration in a vacuum hot press sintering furnace; and 3) preparing the reticular Ti5Si3 and dispersed TiC enhanced TiAl-based composite. The method adopts the reaction pressure infiltration technology to obtain the high density material and increase the oxidation resistance of the TiAl alloy, thus the high-temperature application requirementunder 900 DEG C can be met, the density of the material can be effectively increased and the method is especially suitable for the preparation field of the TiAl alloy.

Claims

(CN102134662)

1 . Mesh Ti5Si3 TiAl-based composite material reinforced by dispersively method of producing TiC, characterized in that it is carried out in the following steps: one, a particle size of 60-120 m of spherical pure titanium particles and the particle size of 1-10 m SiC particles are mechanically mixed powder of the, mixed powder time 10-20 hours, the ball-powder mass ratio of 3:1-10:1, Ti and the SiC mixed powder to obtain a uniform mixture, wherein the finished product of the overall mass of pure titanium particles 67.5-68.2%, the total mass of the SiC particles comprise the finished alloy 3.1-6.4%; di, will be placed in a graphite mold powder mixture prepared in step one to form the bulk of the porous preform, the preform is placed again at the finished together provide the overall mass 25.4-29.4% of the pure aluminum block shape, and then vacuum hot press sintering furnace was charged, was evacuated to 0.001-0.1 mpa rear, heated to 700-900 °C, incubated for 30-60 minutes, then pressurized to 20-40 mpa, to sufficiently penetrate into the porous preform molten aluminum; three, vacuum hot press sintering furnace control conditions change, the reaction was further carried out, conditions of a temperature 1200-1400 °C, time 0.5 hours-2 hours, i.e. to produce a finished mesh Ti5Si3 dispersively TiAl-based composite material reinforced with TiC .

2 . Mesh Ti5Si3 TiAl-based composite material reinforced by TiC dispersively method of manufacturing according to claim 1, characterized in step one time mixed powder 12-18 hours, the ball-powder mass ratio of 5:1-8:1 .

3 . Mesh Ti5Si3 TiAl-based composite material reinforced by TiC dispersively method of manufacturing according to claim 1, characterized in mixed powder time 15 hours in step one, the ball-powder mass ratio of 6:1 .

4 . According to claim 1, 2 or 3 mesh Ti5Si3 TiAl-based composite material reinforced by dispersively method of producing TiC, characterized in step two evacuated to 0.005-0.1 mpa, heated to 750-850 °C, incubated for 30-50 minutes, then pressurized to 25-35 mpa .

5 . Mesh Ti5Si3 TiAl-based composite material reinforced by TiC dispersively method of manufacturing according to claim 3, characterized in step two was evacuated to 0.1 mpa, heated to 800 °C, incubated for 30 minutes, then pressurized to 30 mpa .

6 . According to claim 1, 2 or 3 mesh Ti5Si3 TiAl-based composite material reinforced by dispersively method of producing TiC, characterized in temperature in the third step 1250-1350 °C, 0.5 hour time-1.5 hours .

7 . According to claim 1, 2 or 3 mesh Ti5Si3 dispersively TiAl-based composite material reinforced by TiC method of preparing, characterized in temperature in the third step 1300 °C, time 1 hour.

Method for preparing TiAl-based alloy sheet
CN101979690

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  C22C-001/04 C22C-014/00 C22F-001/18
- **Publication Information**
  CN101979690 A 2011-02-23 [CN101979690]
- **Priority Details**
  2010CN-0561035 2010-11-26
- **Fampat family**

CN101979690	A	2011-02-23	[CN101979690]
CN101979690	B	2012-06-27	[CN101979690B]

- **Abstract:**
  (CN101979690)
  The invention relates to a method for preparing a TiAl-based alloy sheet, and solves the problems that: the conventional method for preparing the TiAl-based alloy from elemental powder has high cost and impurities are easy to introduce; and the conventional TiAl-based alloy is difficult to mold and process due to poor deformability during cold processing. The method comprises the following steps of: mechanically mixing TiH_2 powder and pure Al powder; filling the mixed powder into a graphite die; then carrying out hot pressing sintering to obtain a Ti-Al duplex metal compound; rolling and molding the Ti-Al duplex metal compound to obtain a Ti-Al duplex metal composite sheet; and carrying out hot pressing reactive sintering on the Ti-Al duplex metal composite sheet to synthesize the TiAl-based alloy sheet. The preparation method has low cost and is simple; and cheap TiH_2 powder is taken as the raw material. The TiH_2 powder is fragile powder, the cold welding is difficult to generate in the powder mixing process and the required powder mixing time is short so as to reduce the introduction of the impurities. The method adopts the elemental powder process of molding first and then producing the alloy, overcomes the defect of poor deformability of the fragile TiAl alloy during the cold processing and can sufficiently meet various molding requirements.

Claims

(CN101979690)

1 . One method for producing TiAl-based alloy sheets, characterized in TiAl-based alloy plate material was prepared by following steps: one, by molar percentage will 50%-55% of the TiH2 powder and 45%-50% Al powder are mechanically mixed powder of the 9-30h resulting mixed powder, wherein a mass ratio of the powders 5-10:1, Al powder has a purity of not less than 99% (mass); second, the resulting mixture of powdered to the step of a graphite mold, and then the graphite mold was placed in a vacuum hot press sintering furnace, was evacuated to 0.1-0.001 mpa, then warmed to 500-680 °C, incubated for 60-120min, and then pressurized to 10-30 mpa, longer dwell and retained for 60-120min, resulting Ti-Al two-metal composite; three, step two resulting Ti-Al composite at room temperature bimetal-200 °C rolled under to give Ti-Al composite bi-metal plate materials; four, step three resulting Ti-Al composite sheet placed in a vacuum hot press sintering furnace bimetallic, temperature was raised to 1100-1400 °C rear, then pressurized to 10-30 mpa, and then pressure-holding and retained for 2-4h, allowed to cool to room temperature, cavity-back, resulting TiAl-based alloy plate materials .

2 . One method for producing TiAl-based alloy sheet according to claim 1, characterized in step one mole percentage will of the 52% TiH2 powder and Al powder are mechanically mixed powder of the mixed powder was 48% 24h .

3 . One method for producing TiAl-based alloy sheet according to claim 1 or 2, characterized in step one TiH2 particles having a particle diameter of 30-50 m, particles having a particle size of Al 20-40 m .

4 . One method for producing TiAl-based alloy sheet according to claim 1 or 2, characterized in step two is then heated up to 600 °C, insulation 90min .

5 . One method for producing TiAl-based alloy sheet according to claim 1 or 2, characterized in step two and then pressurized to 20 mpa, longer dwell and retained for 90min .

6 . One method for producing TiAl-based alloy sheet according to claim 1 or 2, characterized in step three-step two resulting Ti-Al bimetallic composite in 100-180 °C rolled under to give Ti-Al bimetallic composite sheet .

7 . One method for producing TiAl-based alloy sheet according to claim 1 or 2, characterized in step three-step two resulting Ti-Al composite body obtained at 150 °C rolled under bi-metallic Ti-Al bimetallic composite sheet .

8 . One method for producing TiAl-based alloy sheet according to claim 1 or 2, characterized in step three rolling the resulting Ti-Al bimetallic composite sheet has a thickness of 1-3 mm .

9 . One method for producing TiAl-based alloy sheet according to claim 1 or 2, characterized in step three rolling the resulting Ti-Al composite sheet has a thickness of bimetal 2 mm .

10 . One method for producing TiAl-based alloy sheet according to claim 1 or 2, characterized in step four fiber was heated at 1200 °C.

Preparation method of TiB2 particle-reinforced TiAl-based composite material CN101906548

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  C22C-001/05
- **Publication Information**
  CN101906548 A 2010-12-08 [CN101906548]
- **Priority Details**
  2010CN-0222300 2010-07-09
- **Fampat family**

CN101906548	A	2010-12-08	[CN101906548]
CN101906548	B	2012-06-06	[CN101906548B]

- **Abstract:**
  (CN101906548)
  The invention relates to a preparation method of a TiB2 particle-reinforced TiAl-based composite material, in particular to a preparation method of a particle-reinforced TiAl-based composite material. The invention solves the problems of high cost, complicated process, serious pollution, nonuniform reinforced phase distribution, incompact tissue and the like existing in the particle-reinforced TiAl-based composite material prepared in the prior art. The method comprises the following steps of: 1 weighing materials; 2 preparing precast blocks; 3 loading; and 4 smelting, pouring and then cooling to obtain the particle-reinforced TiAl-based composite material. The method in the invention has the advantages of low cost, low pollution, accurate component, clean interface of reinforced phases/substrates, uniform reinforced phase distribution and simple process, and the prepared composite material has uniform and fine tissue; the method can be used for directly pouring TiAl composite material ingot castings, be used for carrying out secondary processing formation by combining with subsequent processes of hot forging, hot rolling, hot extrusion and the like, also be used for preparing castings by combining the smelting preparation of the composite material with fired mold casting, and is suitable for industrial production.

Claims

(CN101906548)

1. TiB2 method for producing TiAl-based composite material reinforced particles, TiB2 TiAl-based composite material by volume percentage particle enhanced by 0.8%-20% TiB2 TiAl alloy matrix and the balance of the composition, wherein the TiAl alloy matrix in atomic percentages by 40%-60% Ti, 35%-50% Al and the balance of alloy elements consisting, alloying element is V, Nb, Cr, Mn, Mo, Si, W, Y, C one or several of which are combined, in the TiAl alloy matrix 10% atomic percentage of V, Nb in the TiAl alloy matrix 6% by atomic percent, the atomic percentage of Cr in the TiAl alloy matrix 3%, Mn in the TiAl alloy matrix 3% by atomic percent, the atomic percentage of Mo in the TiAl alloy matrix 2%, Si in the TiAl alloy matrix 2% by atomic percent, the atomic percentage of W in the TiAl alloy matrix 1%, Y in the TiAl alloy matrix 0.3% by atomic percent, the atomic percentage of C in the TiAl alloy matrix 0.3%; characterized in TiB2 TiAl-based composite material is prepared by reinforcing particles in the following step is performed in: one, as TiB2 Ti powder and B powder was weighed out of the content, the content of titanium sponge was weighed out in the TiAl alloy matrix, aluminum block, alloying elements and aluminum master alloy, wherein the aluminum from an aluminum block composition and aluminum powder, aluminum powder that is a referred amount of data thinned TiB2 mass of 5%-10%, the remainder being aluminum block; second, B will step one of the weighed powder, Ti powder and aluminum powder was placed in a blender mixing 5-30h, and then pressed to cause a density of 60%-80% of prefabricated block; three, charge: water-cooled copper crucible was charged with to 60%-70% of the amount of data thinned called titanium sponge, then charged with alloying elements and aluminum master alloy, and then inserted in a preformed block, and then filled into the remaining titanium sponge, finally loaded with aluminum block; four, using a water-cooled copper crucible induction melting apparatus to completely melted insulation 6-20 minutes, the melt is then poured into the preheated to 200-400 °C of die mold, cooling after the prepared TiB2/TiAl composite material.
2. TiB2 TiAl-based composite material of the particle-enhanced production method according to claim 1, characterized in particle-enhanced TiAl-based composite material on a volume percentage by 10%-15% TiB2 TiAl alloy matrix and the balance of the composition.
3. TiB2 particle enhanced method for producing TiAl-based composite material according to claim 1, characterized in particle-enhanced TiAl-based composite material on a volume percentage from 3% TiB2 and a 97% TiAl alloy matrix composition.
4. TiB2 TiAl-based composite material of the particle-enhanced production method according to claim 1, characterized in particle-enhanced TiAl-based composite material on a volume percentage by 7% TiB2 93% TiAl alloy matrix and a composition.
5. TiB2 TiAl-based composite material of the particle-enhanced production method according to claim 1, characterized in particle-enhanced TiAl-based composite material on a volume percentage by 7.5% TiB2 TiAl alloy matrix and the balance of the composition.
6. According to claim 1-5 claimed in any of claims TiB2 particle enhanced method for producing TiAl-based composite material, characterized in TiAl alloy matrix by 47.7% Ti by atomic percentage, 43% Al, 9% V and the 0.3Y % composition.
7. According to claim 1-5 claims in any one of TiB2 particle enhanced method for producing TiAl-based composite material, characterized in TiAl alloy matrix in atomic percentages by 46-52.7% Ti, 42-48.7% Al, 2% V, 2% Nb, 0.3% Y 1% Mo and a composition.
8. According to claim 1-5 claims in any one of TiB2 TiAl-based composite material production method of reinforcing particles, characterized in TiAl alloy matrix in atomic percentages by 51% Ti, 44% Al, 2% V, 2% Nb, 0.5% of the W, 0.3% Y 0.2% C and the composition.
9. According to claim 1-5 claims in any one of TiB2 TiAl-based composite material production method of reinforcing particles, characterized in TiAl alloy matrix in atomic percentages by 43.7%Ti,45%Al,5%V,3%Nb,1%Cr,0.1%Mn,1.5%Si,0.3%Y,0.4%C composition.
10. TiB2 TiAl-based composite material production method of reinforcing particles, TiB2 TiAl-based composite material on a volume percentage by particle enhanced 0.8%-20% TiB2 TiAl alloy matrix and the balance of the composition, wherein the TiAl alloy matrix in atomic percentages by 40%-60% Ti, 35%-50% Al and the balance of alloy elements consisting, alloying element is V, Nb, Cr, Mn, Mo, Si, W, Y, C one or several of which are combined, in the TiAl alloy matrix 10% atomic percentage of V, in the TiAl alloy matrix 6% in atomic percent of Nb, the atomic percentage of Cr in the TiAl alloy matrix 3%, Mn in the TiAl alloy matrix 3% by atomic percent, the atomic percentage of Mo in the TiAl alloy matrix 2%, Si in the TiAl alloy matrix 2% by atomic percent, the atomic percentage of W in the TiAl alloy matrix 1%, Y in the TiAl alloy matrix 0.3% by atomic percent, the atomic percentage of C in the TiAl alloy matrix 0.3%; characterized in TiB2 TiAl-based composite material is prepared by reinforcing particles in the following step is performed in: one, as TiB2 Ti powder and B powder was weighed out of the content, the content of the TiAl alloy matrix was weighed out in the sponge titanium, aluminum, aluminum alloy elements and the master alloy, wherein the aluminum from an aluminum block composition and aluminum powder, aluminum powder is the amount of data to be scaled TiB2 mass of 5%-10%, the remainder being aluminum block; second, B will step one of the weighed powder, Ti powder and aluminum powder was placed in a blender mixing 5-30h, and then pressed to cause a density of 60%-80% of prefabricated block; three, charge: water-cooled copper crucible was charged with to 60%-70% of the amount of data thinned called titanium sponge, then charged with alloying elements and aluminum master alloy, and then inserted in a preformed block, and then filled into the remaining titanium sponge, finally loaded with aluminum block; four, using a water-cooled copper crucible induction melting apparatus to completely melted insulation 6-20 minutes, the melt is then poured into the preheated to 300-800 °C of the investment casting of ceramic molds, mold-filling or directly at 50-300r/min centrifugation at a rotational speed of the mold-filling, cooling after the prepared TiB2/TiAl composite material.

Method for preparing Ti5Si3/TiAl composite material
CN101798642

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- **International Patent Classification**
  C22C-001/08
- **Publication Information**
  CN101798642 A 2010-08-11 [CN101798642]
- **Priority Details**
  2010CN-0100995 2010-01-26

- **Fampat family**

CN101798642	A	2010-08-11	[CN101798642]
CN101798642	B	2012-05-16	[CN101798642B]

- **Abstract:**
  (CN101798642)
  The invention discloses a method for preparing a Ti5Si3/TiAl composite material, relates to a method for preparing a composite material and aims to solve the problems of poor uniformity, relatively lower compactness and high cost of a TiAl composite material prepared by using the prior art. The method comprises the following steps of: stacking pure titanium particles into a steel mold to obtain aporous titanium prefabricated body; and linearly cutting an Al-Si alloy ingot into blocks, placing the blocks on the porous titanium prefabricated body for hot pressing and sintering under a vacuum condition, cooling the porous titanium prefabricated body to room temperature and demolding the porous titanium prefabricated body to obtain the Ti5Si3/TiAl composite material. The method has the advantages of effectively improving material compactness (95 to 98 percent) and structural uniformity, improving high-temperature strength, creep property and oxidation resistance, meeting requirements on practicability, saving the process of ball milling and powder mixing in a powder metallurgical process, reducing the probability of the oxidation of Ti and Al and the blending of new impurities, and reducing the negative influence of the oxidation and the impurities on Ti Al-base alloy plates, and also has the advantages of simple process, easy operation, less equipment and low cost.

Claims

(CN101798642)

1. One Ti5Si3/TiAl method for producing a composite material, characterized in Ti5Si3/TiAl process for the preparation of the composite material is achieved by the following steps: one, with a diameter of 80-120 m pure titanium particles deposited directly into steel molds, resulting porous titanium preform; di, and the Al-Si alloy ingot having dimensions corresponding with the steel mold shape cut into the block, then placed in a porous titanium on the preform, and then placed in a vacuum hot press sintering furnace, vacuum was applied to 0.001-0.01Pa, and then to 10-20 °C/mmin ramped up to 640-800 °C and retained for 30-60min, then pressurized to 5-30 mpa, dwell 0.5-3h, further increasing the temperature to 1100-1400 °C, at a pressure of 10-30 mpa sintered under the conditions of 1-4h, pressure-holding cooling to room temperature back mode, to give Ti5Si3/TiAl composite material; wherein Al-Si alloy and pure titanium by mass of 35-39:61-65, Al-Si alloy containing Si in an amount of 3.6-16.7 wt. %.
2. One Ti5Si3/TiAl process for the preparation of the composite material according to claim 1, characterized in diameter was used in step one 90-110 m pure titanium particles.
3. One Ti5Si3/TiAl process for the preparation of the composite material according to claim 1, characterized in pure titanium particles having a diameter of 100 m employed in step one.
4. One Ti5Si3/TiAl process for the preparation of the composite material according to claim 2 or 3, characterized in step two evacuated to 0.005Pa, and then heated to 650 °C and retained for 55min to 15 °C/min, then pressurized to 10 mpa, packing 3h.
5. One Ti5Si3/TiAl process for the preparation of the composite material according to claim 2 or 3, characterized in step two evacuated to 0.006Pa, and then heated to 700 °C and retained for 45min to 16 °C/min, then pressurized to 20 mpa, dwell 1h.
6. One Ti5Si3/TiAl process for the preparation of the composite material according to claim 2 or 3, characterized in step two evacuated to 0.008Pa, and then ramped up to 780 °C and retained for 35min to 18 °C/min, then pressurized to 30 mpa, dwell 0.5h.
7. One Ti5Si3/TiAl process for the preparation of the composite material according to claim 6, characterized in step two further increasing the temperature to 1200 °C, at a pressure of 15 mpa sintered under the conditions of 2h.
8. One Ti5Si3/TiAl process for the preparation of the composite material according to claim 6, characterized in step two further increasing the temperature to 1300 °C, sintered under the conditions at a pressure of 25 mpa 1h.

Method for preparing TiAl alloy bars
CN101775512

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- **International Patent Classification**
  C22C-001/04

- **Publication Information**
  CN101775512 A 2010-07-14 [CN101775512]
- **Priority Details**
  2010CN-0300526 2010-01-21

- **Fampat family**

CN101775512	A	2010-07-14	[CN101775512]
CN101775512	B	2011-09-21	[CN101775512B]

- **Abstract:**
(CN101775512)
The invention provides a method for preparing TiAl alloy bars, relating to a method for preparing alloy bars. The invention solves the problem of difficult hot extrusion in preparation of the TiAl alloy bars by the existing casting metallurgical method and the problems of easy introduction of impurities and low compactness of the TiAl alloy bars prepared by the powder metallurgical method. The method of the invention is as follows: 1) preparing Ti powder into porous Ti by cold compressing and sintering; 2) forming a hot-pressing piece by the porous Ti and alusil alloy; 3) preparing Ti-Al bimetal complexes by using a vacuum pressure infiltration method; 4) extruding to obtain Ti-Al bimetal composite bars; and 5) performing heat treatment to obtain the TiAl alloy bars. In the invention, theextrusion operation of the bars is carried out at lower temperature, the bar has the advantages that the extrusion is easy, no ball milling process is needed, the impurities are less, the tissues of the bars are uniform and fine, the compactness is 97-99%, and the tensile strength is 730-780 MPa, thereby be capable of being used in the fields of aviation, spaceflight and automobile.

Claims

(CN101775512)

1. TiAl alloy production method according to one of the rod, characterized in TiAl alloy production method according to one rod was done as follows: one, the quality of the spherical titanium powder is added to steel molds 99.5% purity, cold-rolled to a porosity of 45%-55% of the block, the block is then placed into a vacuum sintering furnace, sintering furnace is evacuated to a vacuum degree of vacuum 0.005Pa-0.01Pa rear, was heated to 900 °C -1200 °C and held 1h-3h, to obtain porous titanium preform; second, porous titanium preform is first placed in a steel mold, and then clicking on the Step One resulting porous titanium alloy containing titanium and aluminum of the preform of aluminum were weighed 1:1 molar ratio of silicon-aluminium-silicon alloy, aluminum-silicon alloy is subjected to porous titanium steel mold and the above preform, consisting hot items; three, hot items consisting of step two will be placed in a vacuum hot press sintering furnace, sintering furnace chamber was evacuated to vacuum hot pressing was first 0.001Pa-0.01Pa rear, raised to 590 °C -640 °C and held 30min-120min, and then a vacuum degree of 0.001Pa-0.01Pa, a temperature of 590 °C -640 °C, a pressure of 5 mpa-30 mpa vacuum hot press sintering under conditions of 10min-30min, finally maintain a vacuum level and the pressure, cooled to room temperature, to give the Ti-Al bimetallic complex; four, converts the step three resulting Ti-Al dual-metal complex at a temperature of first 300 °C -500 °C Torr for 30min-60min rear, followed by press 9-an extrusion ratio of 36:1 of the Ti-Al bimetallic composite is extruded into a Ti-Al bimetallic composite rods; five, converts the step four the resulting Ti-Al bimetallic composite rods placed in an electric resistance furnace, first heated to 640 °C -700 °C and held 1h-4h, and continued to rise to 1100 °C -1400 °C and held 3h-7h, and then cooled to room temperature, TiAl alloy rod was obtained.

2. TiAl alloy production method according to one of the rod according to claim 1, characterized in step one spherical titanium powder with particle sizes of 100 m -150 m.

3. Process for preparing TiAl alloy bar stock one according to claim 1 or 2, characterized in step one aluminum-silicon alloy is Al -8% Si, Al -12% Si, Al -15% Si or Al -20% Si.

4. TiAl alloy production method according to one of the rod according to claim 3, characterized in step one after cold block has a porosity of 48%-53%.

5. According to claim 1, 2 or 4 A method for producing TiAl alloy rod, characterized in step one vacuum sintering furnace to a vacuum of 0.006Pa-0.009Pa.

6. TiAl alloy production method according to one bar according to claim 5, characterized in step one vacuum sintering furnace at a temperature of 950 °C -1100 °C, holding for 1.5h-2.5h.

7. According to claim 1, 2, 4 or 6 A method for producing TiAl alloy rod, characterized in step three a vacuum degree of 0.002Pa-0.008Pa, a temperature of 600 °C -630 °C, a pressure of 10 mpa-25 mpa vacuum hot press sintering under conditions of 15min-25min.

8. TiAl alloy production method according to one of the rod according to claim 7, characterized in step four first at a temperature of 350 °C -450 °C Torr for 35min-55min.

9. According to claim 1, 2, 4, 6 or 8 A method for producing TiAl alloy rod, characterized in step four of the extrusion ratio was 12-33:1.

10. TiAl alloy production method according to one bar according to claim 9, characterized in five steps was first heated to 650 °C -680 °C and held for 1.5h-3.5h, and continued to rise to 1150 °C -1350 °C and held 3.5h-6.5h.

Method for preparing Ti2AlN/TiAl compound material by regulating and controlling components accurately

CN101716680

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- **International Patent Classification**
  B22F-003/16
- **Publication Information**
  CN101716680 A 2010-06-02 [CN101716680]
- **Priority Details**
  2009CN-0073422 2009-12-15

- **Fampat family**

CN101716680	A	2010-06-02	[CN101716680]
CN101716680	B	2011-05-18	[CN101716680B]

- **Abstract:**
  (CN101716680)
  The invention discloses a method for preparing a Ti2AlN/TiAl compound material by regulating and controlling components accurately, and relates to the method for preparing a compound material. The method for preparing the Ti2AlN/TiAl compound material by regulating and controlling the components accurately solves the problems that the prior method for preparing the Ti2AlN/TiAl compound material is easy to introduce impurities and is difficult to control the volume fraction of the Ti2AlN/TiAl on large scale. The method comprises the following steps: firstly, putting Ti powder, Al powder and TiN powder into a liquid dispersant according to certain percentage, ball-milling the mixture, and drying the mixture to obtain mixed powder; and secondly, putting the mixed powder into a graphite mold,preserving heat and pressure of the mixed powder at 700 DEG C, 900 DEG C and 1,300 DEG C respectively, and cooling the mixed powder to a room temperature in a furnace so as to obtain the Ti2AlN/TiAl compound material. The method for preparing the Ti2AlN/TiAl compound material of the invention cannot introduce the impurities, and can control the volume fraction of the Ti2AlN/TiAl on a large scale by regulating the addition of the TiN powder.

Claims

(CN101716680)

1. One Ti2AlN/TiAl method for producing composite material components precisely regulated, characterized in Ti2AlN/TiAl composite component precisely regulated was prepared as follows: one, Ti powder will be, Al powder, TiN powder and an alloying element powder into a liquid carrier, and then the Ti powder, Al powder, TiN powder and an alloying element powder total weight and the weight ratio of 1:5 is ready to go, rotating at 300 revolutions/min for 3 hours milling-24 hours, and then at a temperature of 50 °C -100 °C conditions where drying, to obtain a blended powder; di, the mixed powder was placed in a graphite mold, a heating rate of 10 °C/minute from room temperature to 700 °C to, then at 700 °C, a pressure of 20 mpa-60 mpa dwell 1 hour incubation-4 hours; three, passed through the step-processing of the mixed powder was placed in a graphite mold 10 °C/minute ramp rate was increased to 700 °C to 900 °C from, and then at 900 °C, a pressure of 20 mpa-60 mpa dwell 1 hour incubation-4 hours; four, passed through the step three processing being placed in a graphite mold with mixed powder 10 °C/minute ramp rate was increased to 1300 °C to 900 °C from, then at 1300 °C, a pressure of 20 mpa-60 mpa of incubating 0.5 hours dwell-2 hours, and then cooled to room temperature with the furnace, to give Ti2AlN/TiAl composite material; step one alloying elements in an amount of Ti powder, Al powder, TiN powder and an alloying element total weight of the powder 1%-5%, Ti powder and Al powder mass ratio of 62.74-95.22: 34.78-48.17, a mass ratio of Ti powder and TiN powder 62.74-95.22: 7.58-68.26.
2. One Ti2AlN/TiAl method for producing composite material components precisely regulated according to claim 1, characterized in step one liquid dispersing agent is alcohol, acetone or distilled water.
3. One Ti2AlN/TiAl method for producing composite material components precisely regulated according to claim 1 or 2, characterized in step one alloying element is Nb, Cr, Mn, Si and a B in a combination of one or a few.
4. One Ti2AlN/TiAl method for producing composite material components precisely regulated according to claim 3, characterized in step one milling time was 15 hours.
5. According to claim 1, 2 or 4 A Ti2AlN/TiAl precise control of process for producing composite material components, characterized in step two at 700 °C, a pressure of 40 mpa incubated under conditions of the dwell.
6. One Ti2AlN/TiAl method for producing composite material components precisely regulated according to claim 5, characterized in step two insulation will be maintained for 3 hours.
7. According to claim 1, 2, 4 or 6 A Ti2AlN/TiAl precise control of process for producing composite material components, characterized in step three will be put into a mixing of the powder was subjected to step second treatment of the graphite mold at 900 °C, a pressure of 50 mpa incubated under conditions of the dwell.
8. One Ti2AlN/TiAl method for producing composite material components precisely regulated according to claim 7, characterized in step three incubation in a dwell time of 3 hours.
9. According to claim 1, 2, 4, 6 or 8 A Ti2AlN/TiAl precise control of process for producing composite material components, characterized in step four passed through the step of processing a mixed powder was placed in a graphite mold with three at 1300 °C, a pressure of 40 mpa dwell 1 hour incubation.
10. One Ti2AlN/TiAl composite component precisely regulated production method according to claim 9, characterized in step one alloying elements in an amount of Ti powder, Al powder, TiN powder and an alloying element total weight of the powder 4%.

Production method for Gamma-TiAl alloy bar
CN101518794

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  B21C-023/01 B21C-023/08 B21C-031/00 C10M-103/00 C10M-103/02 C21D-001/26
- **Publication Information**
  CN101518794 A 2009-09-02 [CN101518794]
- **Priority Details**
  2009CN-0071615 2009-03-23

- **Fampat family**

CN101518794	A	2009-09-02	[CN101518794]
CN101518794	B	2010-09-15	[CN101518794B]

- **Abstract:**
  (CN101518794)
  The invention relates to a production method for a bar, in particular to a production method for a Gamma-TiAl alloy bar. The production method solves the problems that a Gamma-TiAl alloy bar produced The invention relates to a production method for a bar, in particular to a production method for a Gamma-TiAl alloy bar. The production method solves the problems that a Gamma-TiAl alloy bar producedbcooling, and obtaining the Gamma-TiAl alloy bar. The obtained bar has the advantages of no surface cracks, even diameter, even size of crystal grains and no fusion caused by the reaction of the Gammr cooling, and obtaining the Gamma-TiAl alloy bar. The obtained bar has the advantages of no surface cracks, even diameter, even size of crystal grains and no fusion caused by the reaction of the Gamma-TiAl alloy and the sheath.a-TiAl alloy and the sheath.y the prior method has the defects of surface cracks, uneven diameter, uneven size of crystal grains and easy fusion caused by the reaction of Gamma-TiAl alloy and blank at high extrusion temperatureby the prior method has the defects of surface cracks, uneven diameter, uneven size of crystal grains and easy fusion caused by the reaction of Gamma-TiAl alloy and blank at high extrusion temperature. The production method comprises the steps: heating a cast ingot, keeping temperature and annealing; cutting a cylinder in the cast ingot, packaging aluminum silicate fibers, placing in the middle of. The production method comprises the steps: heating a cast ingot, keeping temperature and annealing; cutting a cylinder in the cast ingot, packaging aluminum silicate fibers, placing in the middle ofa stainless steel pipe, and sealing both ends to obtain the blank; washing the sheathed blank, drying and heating the sheathed blank, keeping temperature, placing the sheathed blank in the air, putti a stainless steel pipe, and sealing both ends to obtain the blank; washing the sheathed blank, drying and heating the sheathed blank, keeping temperature, placing the sheathed blank in the air, putting the sheathed blank into a cup pre-pressured by glass lubricant, putting the sheathed blank into a mould to extrude to obtain the bar; annealing the bar, taking the bar out of a blast furnace for aing the sheathed blank into a cup pre-pressured by glass lubricant, putting the

sheathed blank into a mould to extrude to obtain the bar; annealing the bar, taking the bar out of a blast furnace for air

Claims

(CN101518794)

1. One -TiAl alloy process for the preparation of the rod, characterized in -TiAl alloy process for the preparation of the bar stock was done as follows: one, of the -TiAl alloy ingot is placed in hot isostatic pressing furnace, at 1250-1280 °C, 130-140 mpa incubated in an argon atmosphere to 4-5h followed by furnace cooling of tapping, and then placed in 1250-1300 °C under conditions of homogenization annealing 12-24h, furnace cooling of tapping; second, after the annealing of the -TiAl alloy ingot cut in the cylinder of the desired size, before it is wrapped with a thickness of 2-7 mm aluminum silicate fibers, and then in a wall thickness of 2-7 mm stainless steel tube of the middle portion, and the stainless steel tube at both ends with a thickness of 2-7 mm under an argon atmosphere for a stainless steel plate weld seaming, resulting envelope blank; three, ultrasonic cleaning in an acetone solution of the envelope blank 3-6min envelope blank was then left to dry, then placed in a 1200-1400 °C of incubating 3-4h and then withdrawn, and the atmosphere for 10-30s, then placed in a glass lubricant compacted mass of the cup, and then placed in a preheated mold and then heat pressing, to obtain bar; four, placed on a rod 900-1000 °C annealing under conditions of 1-4h, air-cooled then baked, to obtain a -TiAl alloy bar; a purity of 99.99% by mass of argon which step one; in step two is a cylinder with a stainless steel pipe wrapped aluminum silicate fibers such as high, and with no gap between the inner wall of the stainless steel tube; step three are preheated in a mold temperature of 150-200 °C; in the third step of hot extrusion extrusion ratio is 6-9:1, an extrusion speed of 0.1-0.5 m/s.
2. One -TiAl alloy process for the preparation of the rod according to claim 1, characterized in step one in the 1270 °C, incubated in an argon atmosphere to 130 mpa 4h.
3. One -TiAl alloy process for the preparation of the rod according to claim 2, characterized in step one is placed under the conditions of 1260 °C homogenized 16h.
4. One -TiAl alloy process for the preparation of the rod according to claim 3, characterized in having a thickness of 5 mm package in step two of the aluminum silicate fibers.
5. One -TiAl alloy process for the preparation of the rod according to claim 4, characterized in step two is placed in a stainless steel tube wall thickness of 3 mm central portion, and the stainless steel tube having a thickness of 3 mm at both ends with a stainless steel plate in an argon atmosphere for welding sealing.
6. One -TiAl alloy process for the preparation of the rod according to claim 5, characterized in step three the glass lubricant in an amount by weight percent 50%-69% of the L glass, 30%-40% of graphite and 1%-10% clay made; wherein L glass in terms of mass percent by 10%-15% of the TiO_2,3%-5% of the B_2O_3,0.9%-1.0% of the Al_2O_3,0.9%-1.0% of the SiO_2,0.9%-2.0% of the Cr_2O_3,0.9%-2.0% of the Fe_2O_3 and the balance PbO made.
7. One -TiAl alloy process for the preparation of the rod according to claim 1 or 6, characterized in glass production process of the lubricant in the third step is carried out in the following steps: one, all percentages by weight was separately weighed 50%-69% of the L glass, 30%-40% of graphite and 1%-10% clay; second, L samples weighing glass and clay into a high aluminum crucible, at a temperature of 1050-1100 °C under conditions of the sintering to melting, followed by water quenching, resulting glass pieces; three, of the glass pieces were ground to a particle size of 100-150 purpose glass fine powder, were weighed and then mixed with a graphite mixed, and then the milling rate was 40-60r/min under the conditions, a ball mill 24-48h, that is to be used for the -TiAl alloy extruded rod-shaped glass lubricant; wherein L glass in terms of mass percent by 10%-15% of the TiO_2,3%-5% of the B_2O_3,0.9%-1.0% of the Al_2O_3,0.9%-1.0% of the SiO_2,0.9%-2.0% of the Cr_2O_3,0.9%-2.0% of the Fe_2O_3 and the balance PbO made.
8. One -TiAl alloy process for the preparation of the rod according to claim 7, characterized in step three is placed in and taken out of incubating 3.5h 1300 °C, and allowed to air placed 10s.
9. One -TiAl alloy process for the preparation of the rod according to claim 8, characterized in step three are preheated in a mold temperature of 160 °C.
10. One -TiAl alloy process for the preparation of the rod according to claim 9, characterized in step three the hot extrusion of the extrusion ratio is 7:1, an extrusion speed of 0.3 m/s.

Method for preparing TiAl-based composite material sheet material
CN101497082

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  B21B-001/38 B21B-047/00 B21C-023/02 B21C-037/02 B22F-003/12 C21D-009/46 C21D-011/00
- **Publication Information**
  CN101497082 A 2009-08-05 [CN101497082]
- **Priority Details**
  2009CN-0071585 2009-03-19

- **Fampat family**

CN101497082	A	2009-08-05	[CN101497082]
CN101497082	B	2011-05-11	[CN101497082B]

- **Abstract:**
  (CN101497082)
  The invention provides a method for preparing a TiAl-based composite material plate, and relates to a method for preparing the composite material plate. The method solves the problems that TiAl-based alloy prepared by the prior process has poor uniformity and compactness in texture and serious internal oxidation phenomenon, and only block body TiAl-based composite material can be prepared by a composite strengthening and toughening method. The method of the invention comprises the following steps that: firstly, aluminum-based composite material plates and pure tatinium plates are alternately laminated and subjected to hot pressing and hot rolling to prepare a multilayer composite plate; and secondly, the multilayer composite plate is subjected to heat treatment to prepare the TiAl-based composite material plate. The TiAl-based composite material plate obtained by the method has good uniformity and compactness in texture, and has no internal oxidation; and compared with the block body TiAl-based composite material, the plate type TiAl-based composite material has convenient use and wide application field.

Claims

(CN101497082)

1. TiAl-based composite material production method of a plate material, characterized in TiAl-based composite material plate according to the following steps are methods of preparing: one, by alternately stacking aluminum-based composite material plate of the plate materials and pure titanium, at 200-500 °C, 28-32 mpa thermode conditions where 0.5-3 hours, and then at 200-500 °C under conditions of hot rolling, to give a multilayer composite sheet; second, the resulting multi-layer composite plate material in a first step 500-700 °C heat treatment under conditions of 5-25 hours, and then at 800-1000 °C heat treatment under conditions of 5-25 hours, TiAl-based composite material plate is obtained.
2. Method for producing TiAl-based composite material plate according to claim 1, characterized in step one aluminum-based composite material plate according to the number of layers are alternately stacked plate materials and pure titanium layer provided as 2n + 1, n is a positive integer, and the n 50; wherein the outermost layer is a pure titanium sheet.
3. Method for producing TiAl-based composite material plate according to claim 1 or 2, characterized in a first step of the aluminum-based composite material sheet has a thickness of 0.05-0.3 mm.
4. TiAl-based composite material sheet production method according to claim 3, characterized in step one pure titanium sheet having a thickness of 0.05-0.3 mm.
5. According to claim 1, 2 or 4 TiAl-based composite material production method of the sheet material, characterized in preparation of aluminum-based composite material plate in the first step is carried out as follows: first, an average diameter of 0.5-3 m of silicon carbide particles having an average diameter of 18-45 m of aluminum powder is placed in a ball mill mixing, the mixture is then placed at a temperature of 550-650 °C, a pressure of 30-34 mpa hot press sintering under the condition that a diameter of 48-80 mm cylinder, the cylinder is placed within 400-600 °C condition was hot extruded to a thickness of 4-12 mm of the plate materials, the sheet is then placed within 25-400 °C hot rolling mill using a two-strip club conditions to a thickness of 0.1-2 mm sheets, and again with dresser sanded to a thickness of 0.05-0.3 mm, to obtain the aluminum matrix composite plate materials.
6. Method for producing TiAl-based composite material plate according to claim 5, characterized in step one of the alternate lamination of an aluminum based composite material plate and a pure titanium sheet, at 300-400 °C, 29-31 mpa thermode conditions where 1-2 hours.
7. According to claim 1, 2, 4 or 6 TiAl-based composite material production method of the sheet material, characterized in multi-layer composite sheet in the second step 550-650 °C heat treatment under conditions of 10-20 hours, then at 850-950 °C heat treatment under conditions of 10-20 hours.

Method for preparing TiAl-based alloy formwork by precision-investment casting CN101462151

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- **International Patent Classification**
  B22C-003/00 B22C-007/02 B22C-009/04

- **Publication Information**
  CN101462151 A 2009-06-24 [CN101462151]
- **Priority Details**
  2009CN-0071295 2009-01-16

- **Fampat family**

CN101462151	A	2009-06-24	[CN101462151]
CN101462151	B	2010-09-08	[CN101462151B]

- **Abstract:**
  (CN101462151)
  The invention discloses a method for preparing a shuttering for a precision investment casting TiAl-based alloy, and relates to a method for preparing an oxide ceramic shuttering. The method solves the problems of slow drying for making the shuttering, longer production period for cast and high cost during production of a TiAl-based alloy precise cast. The preparation method comprises: firstly, adopting SLS technology to prepare a fusible pattern; secondly, coating polyvinyl alcohol on the surface of bauxite and grinding the bauxite into granules; thirdly, smearing a shuttering surface layer;fourthly, smearing a shuttering back layer; fifthly, removing wax from the shuttering, and roasting the shuttering; and sixthly, casting the TiAl-based alloy in vacuum to obtain the TiAl-based alloy cast. The method only needs 13 to 15 days to obtain the TiAl-based alloy precise cast from CAD design, but the prior method at least needs 45 to 60 days, so the method saves nearly two thirds of production period, and the manufacturing cost is correspondingly lowered.

Claims

(CN101462151)

1. One method for producing TiAl-based alloy investment casting formwork, characterized in investment casting TiAl based alloy according to the following steps implemented method for producing a formwork: one, three-dimensional CAD model designed using software SolidWorks, STL files saved as magic converted by software, and the STL file data information to the SLS rapid molding machine, with a diameter of less than 0.2 mm of the selective laser sintering technique polystyrene powder sintered layer by layer, again made after baptist wax investment, and then dried with industrial alcohol to the investment surface and the interior for cleaning, drying; di, 60-mesh bauxite sand and polyvinyl alcohol 1788 powder will be added to the distilled water and shaken at a stirring speed of 300-400r/min was stirred until a uniform powder packaged in polyvinyl alcohol 1788 bauxite sand surface, and then at a temperature of 60-80 °C conditions, drying treatment 3-4h and ground 1h; three, zirconium powder with zirconium press head oxidation will be 325 diacetate 2.5-3.8: 1 mass ratio after mixing, zirconium volume of the diacetate was added 0.02%-0.08% of a fatty alcohol ethoxylate and 0.04%-0.07% of the n-octanol, at a stirring speed of 300-400r/min followed by stirring 1-2h, 30min then allowed to stand, resulting finish coating, and then the investment is immersed in pulp stained finish coating 10-15s and then withdrawn, encased in a continuous-flow and out flow uniform finish coating followed by finish sanding, dried; four, 325-mesh bauxite powder with silica sol will be at 2.5-mass ratio of 3:1 mixed, resulting flow cup viscosity of 60-100s of the back layer coating, and then the backing 1-7 hung coated layer, resulting mold shell; five, of the formwork is placed in a box-type electric resistance furnace, oven temperature was raised to 200-400 °C insulation 1-2h, then warmed to 500-700 °C insulation 1-2h, further increasing the temperature to 900-1050 °C insulation 1-2h, with the furnace is then cooled to room temperature, resulting TiAl-based alloy casting formwork with oxide ceramics; six, and the TiAl-based alloy casting formwork placed on water-cooled copper crucible with an oxide ceramic vacuum induction melting furnace, was evacuated to 10-2mbar TiAl-based alloy after melting, casting TiAl-based alloy with an oxide ceramic mold shell at a preheating temperature of 300-400 °C under conditions of the casting, TiAl-based alloy casting obtained; wherein in step two by 0.8-1.5: 0.8-1.5 ratio by mass of distilled water were weighed out sand and bauxite, re-weighed mass of the distilled water 0.5%-1.2% polyvinyl alcohol 1788 powder; in step three of the topcoat paints having a viscosity of flow cup 70-110s, sanding is used in a particle size 30-60 mesh zirconia sand; 1st to 6th layers applied in step four hanging include dipping layer and the sanding two steps, four steps used in the surface-coated in step two sanding material is polyvinyl alcohol 1788 powder bauxite sand and non-treated bauxite sand, both mass ratio of 1:1, and mix well; 7th layer in the dipping is performed only during the tu hanging, without performing the sanding, in step four time intervals tu hanging when the hanging coating layer to layer to 20min.
2. One method for producing TiAl-based alloy investment casting formwork according to claim 1, characterized in step two stirring speed of 320-380r/min.
3. One method for producing TiAl-based alloy investment casting formwork according to claim 1 or 2, characterized in step two by 0.9-1.2: 0.8-1.2 mass ratio of distilled water were weighed sand and bauxite.
4. One method for producing TiAl-based alloy investment casting formwork according to claim 3, characterized in distilled water were weighed in step two quality accounts for 0.6%-1.0% of polyvinyl alcohol 1788 powder.
5. According to claim 1, 2 or 4 A method for producing TiAl-based alloy investment casting formwork, characterized in step three the zirconium powder with zirconium press head oxidation 325 diacetate 2.8-3.2: 1 mass ratio of the mixture.
6. TiAl-based alloy formwork one investment casting method for producing according to claim 5, characterized in step three based on zirconium volume diacetate was added 0.04-0.06% of a fatty alcohol ethoxylate and 0.06% of the n-octanol.
7. According to claim 1, 2, 4 or 6 A method for producing TiAl-based alloy investment casting formwork, characterized in step three the flow cup of the topcoat paints having a viscosity of 80-100s.
8. One method for producing TiAl-based alloy investment casting formwork according to claim 7, characterized in sanding is used in step three particle size in the 40-50 mesh between zirconia sand.
9. According to claim 1, 2, 4, 6 or 8 A method for producing TiAl-based alloy investment casting formwork, characterized in step 325 mesh bauxite powder with silica sol will be four at 2.6-2.8: 1 mass ratio of the mixture.
10. TiAl-based alloy formwork one investment casting method for producing according to claim 9, characterized in step four back layer coating of the flow cup viscosity of 70-90s.

Method for preparing TiAl alloy clad plate by pre-alloying powder
CN101011740

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- **International Patent Classification**
  B22F-007/04
- **Publication Information**
  CN101011740 A 2007-08-08 [CN101011740]
- **Priority Details**
  2007CN-0071715 2007-01-31

- **Fampat family**

CN101011740	A	2007-08-08	[CN101011740]
CN100496817	C	2009-06-10	[CN100496817C]

- **Abstract:**
  (CN101011740)
  The invention relates to the making of Tial alloy clad board, which gets alloy blanks of 0.4-10mm after cold pressing of the TiAl alloy powder, stacking it with 0.2-5mm Ti alloy plate with them spaced and wrapped together, with overall degasification and sealing, then hot isostatic and high temperature rolling to get the compound board after removing the wrap. It can improve the plasticization of the board significantly, with finer strength and machining feature.

Claims

(CN101011740)

1. TiAl alloy powder a prealloyed method of preparing a composite sheet, characterized in pre-alloyed powder TiAl alloy composite sheet prepared by the following technical scheme is implemented method steps: one, prepared raw material: raw material is TiAl alloy of prealloyed powder, aluminum powder prealloyed TiAl alloy content of 35-55at.%, a titanium content of 35-60at.%, the balance being:Nb,Cr,Mn,V,Ni,W,Hf,Ta,Mo,Zr,Si,Y,La,Ce,C,B,TiC,TiB,TiB2 one of elements or compounds, or a mixture of two or more, TiAl alloy pre-alloyed powder has a particle size less than 200 microns; second, preparation of prefabricated slabs: TiAl alloy pre-alloyed powder subjected to a cold press to give the prefabricated slabs, prefabricated slabs having a thickness of 0.4-10 mm; three, sheath: the prefabricated slab with a thickness of 0.2-5 mm titanium alloy sheets of the stack is placed, followed by a common sheath, the sheath material may be used stainless steel, pure titanium or a titanium alloy, having a thickness of the capsule 3-20 mm, a preformed laminate is placed in the slab and said titanium alloy sheet materials, plate materials ensure that at least one layer of titanium, titanium alloy plate is spaced apart from the prefabricated slab and, after degassing and hermetically sealing the whole capsule; four, hot isostatic pressing: an overall material is subjected to hot isostatic pressing treatment after sealing, hot isostatic pressing process are: temperature 800-1300 °C, pressure 50-300 mpa, time 0.5-4 hours; five, high-temperature rolling: rolling process is: the whole material placed into a furnace heated to 600-1300 °C, and retained for 5-40 minutes, and then quickly placed in the open rolling mill; pass amount of warping is 2-20%, the rolling total deformation of 30-80%, the rolled material integrally with the furnace cooled to 400-600 °C, and then cooled to room temperature; six, removing the capsule: processed using machines are removed from the sheath, to obtain titanium alloy/TiAl alloy composite sheet.
2. TiAl alloy powder a prealloyed method of preparing a composite sheet according to claim 1, characterized in TiAl alloy of prealloyed powder by atomic percentage of the content of Ti -45Al-9Nb-0.25Y.
3. TiAl alloy powder a prealloyed method of making a composite sheet according to claim 1, characterized in TiAl alloy of prealloyed powder by atomic percentage of the content of Ti -46.5Al-3Nb-2Cr-0.4B.
4. TiAl alloy powder a prealloyed method of a composite board prepared according to claim 1, characterized in powder particle size of less than 50 microns.
5. TiAl alloy powder to prepare a prealloyed method of the composite sheet according to claim 1, characterized in powder particle size of 5-30 microns.
6. TiAl alloy powder a prealloyed method of preparing a composite sheet according to claim 1, characterized in precast slab has a thickness of 8 mm.
7. TiAl alloy powder a prealloyed method of preparing a composite sheet according to claim 1, characterized in hot isostatic pressing process are: temperature 1050 °C, pressure 150 mpa, 3 hours time.
8. TiAl alloy composite sheet material producing a prealloyed powder method according to claim 1, characterized in hot isostatic pressing process are: temperature 950 °C, pressure 100 mpa, 2 hours time.
9. TiAl alloy a prealloyed powder preparation method of the composite sheet according to claim 1, characterized in 12% amount of the flow pass, rolling total deformation of 75%.
10. TiAl alloy powder a prealloyed method of preparing a composite sheet according to claim 1, characterized in 15% amount of the flow pass, rolling total deformation of 70%.

TiAl-base composite material enhanced by three-dimensional network Ti2AlC and manufacturing method thereof

CN101011737

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- **International Patent Classification**
  B22F-003/10
- **Publication Information**
  CN101011737 A 2007-08-08 [CN101011737]
- **Priority Details**
  2007CN-0071708 2007-01-31

- **Fampat family**

CN101011737	A	2007-08-08	[CN101011737]
CN100496815	C	2009-06-10	[CN100496815C]

- **Abstract:**
  (CN101011737)
  The invention relates to the making of TiAl based composite material with reinforced three dimensional net structure Ti2AlC. It solves the poor indoor plasticization and low strength issue of existing material. The newly invented material is made in the following combination based on atomic percentage: Ti powder 45-50at.%, Al powder 40-49at.%, 1-15at.% of one or more of Nb,Cr,Mn,V, Ni,W,Ta,Mo,Zr,Si,B powders, and carbon nanometer tube with the total weight of Ti, Al and element powder 0.05-20%, with two or more of Nb,Cr,Mn,V,Ni,W, Ta,Mo,Zr,Si,B, with all the element powders in random atomic percentages. It is made through ball grinding, mixing powder after feeding carbon nanometer tube, plasma sintering to get the final product.

Claims

(CN101011737)

1. Three-dimensional network structure Ti2AlC enhanced TiAl-based composite material, characterized in three-dimensional network structure Ti2AlC enhanced TiAl-based composite material according to the atomic ratio by 45-50at.% Ti of the powder, 40 -49at.% of the Al powder and 1-15at.% of the Nb, Cr, Mn, V, Ni, W, Ta, Mo, Zr, Si, B element powder and one or more of the Ti powder, Al powder and elemental powder total weight 0.05-20% of the carbon nanotube, wherein Nb, Cr, Mn, V, Ni, W, Ta, Mo, Zr, Si or B 2 or 2 kinds or more are elemental powders as, for any atomic ratio between elemental powders.
2. Three-dimensional network structure Ti2AlC enhanced TiAl-based composite material according to claim 1, characterized in three-dimensional network structure Ti2AlC TiAl-based composite material reinforced by an atomic ratio by 46-49at.% Ti of the powder, 42-48at.% of the Al powder and 3-12at.% of the Nb, Cr, Mn, V, Ni, W, Ta, Mo, Zr, Si, B element powder and one or more of the Ti powder, the total weight of Al powder and elemental powder 5-15% of the carbon nanotube.
3. Three-dimensional network structure Ti2AlC enhanced TiAl-based composite material according to claim 1, characterized in three-dimensional network structure Ti2AlC TiAl-based composite material reinforced by an atomic ratio of the Ti powder by 48at.%, Al powder and Nb of the 6at.% of the 46at.%, Cr, Mn, V, Ni, W, Ta, Mo, Zr, Si, B element powder and one or more of the Ti powder, Al powder and 10% of the total weight elemental powders made of carbon nanotubes.
4. TiAl-based composite material production process, characterized in three-dimensional network structure Ti2AlC enhanced TiAl-based composite material prepared by following steps of the method: (one) in terms of atomic ratio could be 45-50at.% Ti of the powder, 40-49at.% of the Al powder and 1-15at.% of the Nb, Cr, Mn, V, Ni, W, Ta, Mo, Zr, Si, B of one or several elements in the elemental powders are blended in a powder in a ball mill, wherein Nb, Cr, Mn, V, Ni, W, Ta, Mo, Zr, Si or B 2 or 2 kinds or more are elemental powders as, for any atomic ratio between elemental powders, having a purity of 99.99% in the milling tank was filled with an argon gas, a weight ratio of the powders 4-50:1, a ball mill speed was 100-1000 rev/min under the conditions of milling the mixed powder 2-100 hours, to obtain a composite powder; (di) in the composite powder into a powder by weight was added 0.05-20% of the carbon nanotubes, and then in a ball mill for 5-100 revolutions/min speed of low speed mixed powder 0.5-20 hours, to give homogeneous dispersion of the carbonaceous nanotube composite powder; (three) of the nanotubes in a plasma sintering furnace the volatiles in the composite powder to 650 °C -1550 °C, pressure in the range of 5-100KN and a vacuum of from 0-10Pa sintering conditions of the 2 minutes-2 hours, and then having a purity of 99.99% of nitrogen was passed through to the sintering furnace and is cooled to room temperature, to obtain three-dimensional network structure Ti2AlC enhanced TiAl-based composite material.
5. Three-dimensional network structure Ti2AlC enhanced TiAl-based composite material production method according to claim 4, characterized in step (A) in terms of atomic ratio will 46-49at.% Ti of the powder, 42-48at.% of the Al powder and 3-12at.% of the Nb, Cr, Mn, V, Ni, W, Ta, Mo, Zr, Si, one or more of the B element powder are blended in a ball mill.
6. Three-dimensional network structure Ti2AlC method for producing TiAl-based composite material reinforced according to claim 4, characterized in step (one) weight ratio of the powders 10-45:1, a ball mill speed was 200-800 revolutions/min.
7. Three-dimensional network structure Ti2AlC method for producing TiAl-based composite material reinforced according to claim 4, characterized in step (one) in the milling the mixed powder 20-80 hours.
8. TiAl-based composite material production method according to claim 4, characterized in step (di) in the composite powder mixed with the powder weight 5-15% of the carbon nano-tube.
9. Three-dimensional network structure Ti2AlC method for producing TiAl-based composite material reinforced according to claim 4, characterized in step (three) of the nanotubes in the composite powder in a plasma sintering furnace the volatiles to 800 °C - 1200 °C, pressure in the range of 20-80KN and a vacuum degree of 2-8Pa sintering conditions of 20 minutes-1 hour.
10. Three-dimensional network structure Ti2AlC enhanced TiAl-based composite material production method according to claim 4, characterized in step (three) of the nanotubes in the composite powder in a plasma sintering furnace the volatiles to 1000 °C, and a vacuum pressure ranging from 50 minutes 65KN 6Pa conditions for sintering.

Method for preparing TiAl alloy clad plate by element powder
CN101011739

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• **Fampat family**

CN101011739	A	2007-08-08	[CN101011739]
CN100496816	C	2009-06-10	[CN100496816C]

• **Abstract:**
(CN101011739)
The invention relates to the making of TIAl alloy compound plate using element powders, which mixes the element powders like Ti, Al and others in proportion evenly, getting the plate blank after cold rolling or compression, combining the blank and Ti alloy plate with certain thickness for heat compression or hot isostatic treatment to get the compound board. It makes the board with finer structure, thin board, with better comprehensive mechanic feature, being able to make high performance and big size compound board.

Claims

(CN101011739)

1. TiAl alloy element powder prepared by one method of the composite sheet, characterized in TiAl alloy element powder prepared by one method of the composite sheet comprises the following steps: first, preparing a raw material: Ti powder taken, Al powder and other powders, other powder is Nb,Cr,Mn,V,Ni,W,Hf,Ta,Mo,Zr,Si,Y,La,Ce,C,B,TiC,TiB,TiB2 powder of one or more than one mixing, Ti powder, Al powder and other powder has a particle dimension is less than 200 microns, the total Ti powder raw material powder thus 35-60at.%, Al powder of the total powder 35-55at.%, the balance being other powder; second, mixed powder: Ti powder will be, Al powder and other powders were mixed, was mixed powder, mixed powder time was 1-100 hours, so that several powder evenly mixed; three, preparation of prefabricated slabs: the well-mixed powder is rinsed with cold-rolled or cold molding obtained after the prefabricated slabs, prefabricated slabs having a thickness of 0.4-25 mm; four, sheath: titanium alloy or pure titanium with a thickness of the prefabricated slab plate materials are co-sheath, the sheath material is made of stainless steel, pure titanium or a titanium alloy, the envelope having a thickness of 0.5-20 mm, titanium alloy or pure titanium plate materials are laminated with the slab in which pre-placed, titanium alloy or pure titanium sheet in the stack at least one warranted, pure titanium or a titanium alloy slab and prefabricated spaced from plate materials, the whole area after the capsule is degassed and sealed; five, hot pressing or hot isostatic pressing: after sealing an overall by hot pressing or hot isostatic pressing treatment, the heat-preservation element powder reaction occurring, TiAl intermetallic compound TiAl alloy or generated, and compared with a titanium alloy composite board, heat-pressing process are: temperature 600-1500 °C, pressure 20-200 mpa, time 0.2-10 hours; hot isostatic pressing process are: temperature 700-1450 °C, pressure 30-300 mpa, time 0.5-4 hours; six, removing the capsule: machining to remove the sheath, thereby obtaining a titanium alloy/TiAl alloy composite sheet.
2. TiAl alloy powder prepared by one method of the composite sheet element according to claim 1, characterized in TiAl alloy powder prepared for use elements of the composite board further comprises a high-temperature rolling step, the resulting titanium alloy/TiAl alloy composite sheet will claim 1 followed by a high-temperature rolling, before rolling a stainless steel, pure titanium or titanium alloy to the sheath, the sheath having a thickness of 0.5-20 mm, the rolling process is: the whole material placed into a furnace heated to 750-1400 °C, and incubated for 6-45 minutes, and then quickly placed in the open rolling mill; amount of the flow pass 4-18%, between passes to the furnace 5-20 minutes, rolled total deformation of 10-60%, the overall material after rolling at 750-1400 °C with furnace cooled to 450-650 °C, and then cooled to room temperature it is possible.
3. TiAl alloy powder with elemental one method of preparing a composite sheet according to claim 1 or 2, characterized in the starting material is Ti powder, Al powder, Nb powder and Cr powder, powder having a particle size of 5-30 microns, the total Ti powder raw material powder thus 49at.%, Al powder 47at.% of the total powder, Nb powder 2at.% of the total powder, Cr powder of the total powder 2at. %.
4. TiAl alloy composite board with one method of preparing elemental powders according to claim 1 or 2, characterized in the starting material is Ti powder, Al powder and V powder, powder having a particle size of 10-25 microns, the total of the powder raw material powder 48at.% Ti, Al powder 43at.% of the total powder, V powder of the total powder 9at. %.
5. TiAl alloy composite sheet with a method of preparing elemental powders according to claim 1 or 2, characterized in precast slab has a thickness of 7 mm.
6. TiAl alloy powder with elemental one method of preparing a composite sheet according to claim 1 or 2, characterized in precast slab has a thickness of 10 mm.
7. TiAl alloy powder with elemental one method of preparing a composite sheet according to claim 1 or 2, characterized in using the sheath material 304# stainless steel.
8. TiAl alloy element powder prepared by one method of the composite sheet according to claim 1 or 2, characterized in envelope thickness of 2 mm.
9. TiAl alloy element powder prepared by one method of the composite sheet according to claim 1 or 2, characterized in hot isostatic pressing process are: temperature 1350 °C, pressure 250 mpa, 3 hours time.
10. TiAl alloy element powder prepared by one method of the composite sheet according to claim 1 or 2, characterized in hot isostatic pressing process are: temperature 1400 °C, pressure 280 mpa, 4 hours time.

Method for producing TiAl alloy plates through beta-gamma TiAl pre-alloy powder CN104550964

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- **International Patent Classification**
  B22F-001/00 B22F-003/15 B22F-003/24 C22C-014/00
- **Publication Information**
  CN104550964 A 2015-04-29 [CN104550964]
- **Priority Details**
  2015CN-0028162 2015-01-20
- **Fampat family**
  CN104550964 A 2015-04-29 [CN104550964]

- **Abstract:**
  (CN104550964)
  A method for producing TiAl alloy plates through beta-gamma TiAl pre-alloy powder relates to a method for producing TiAl alloy plates. The purpose is to solve problems of the TiAl alloy plates produced by the existing method of macroscopic segregation, dendritic segregation and chemical composition unevenness, poor performance and production difficulty. The method includes: raw material preparing, hot isostatic pressing, sheath packing, high temperature pack rolling and pack removing. The method produces TiAl alloy plates by adopting hot isostatic pressing and follow-up high temperature pack rolling, a large number of disordered body-centered cubic beta phases are introduced in beta-gamma TiAl pre-alloy powder at the processing temperature, thus the hot workability of TiAl alloy can be improved and later TiAl alloy roll forming can be facilitated, and full-density large-size TiAl alloy plates can be produced easily. The method is applicable to producing of TiAl alloy plates.

Claims

(CN104550964)

1. A beta-gamma TiAl TiAl alloy sheet prepared pre-alloyed powder method, characterized in a beta-gamma TiAl pre-alloyed powder alloy sheet in particular to a method of preparing TiAl performed steps of:

A, the raw material preparation: 0.5 m particle diameter is weighed-325 m nominal chemical composition is Ti-(40-44.5) Al-(0.1-10) X-(0.1-1) Z (at %) of beta-gamma TiAl pre-alloyed powder;

In the step one Ti-(40-44.5) Al-(0.1-10) X-(0.1-1) Z (at %) is in the beta phase stabilizing elements X; Mo of beta phase stabilizing elements, Cr, Nb, V, W, one or several Mn Fe and the mixed species; Z of alloying elements; B of alloying elements, one or several Y C and a mixture;

A nominal chemical composition of shell in step Ti-(40-44.5) Al-(0.1-10) X-(0.1-1) Z (at %) of beta-gamma TiAl pre-alloyed powder is by inert gas atomization of the rotating electrode atomization technique or plasma technique;

Second, hot isostatic pressing: step a weighed particle size of from 0.5 m-to 325 m of the nominal chemistry Ti-(40-44.5) Al-(0.1-10) X-(0.1-1) Z (at %) of beta-gamma TiAl envelope placed in a pre-alloyed powder, the tap on the tap 5min-60min, and subjected to vacuum degassing 1h-4h, followed by the sealing, containing beta-gamma TiAl pre-alloyed powder of the envelope, and then subjected to hot isostatic pressing treatment, resulting coated envelope blank TiAl;

Step two vacuum degasification is 200 °C -500 °C, pressure 10-3Pa;

Hot isostatic pressing treatment in the second step is at a temperature of 1000 °C -1250 °C, a pressure of 140M Pa -200 mpa, time 1h is -4h;

The envelope is made of stainless steel in the second step, titanium or titanium alloy;

Step two sheath has a thickness of 1 mm -20 mm;

Third, envelope: removal of the mechanical processing step of two outer envelope blank obtained, the envelope and the rounded blank to again, and then cut, having a surface finish obtained Ra6-Ra8, size (200-600) mmx (100-500) mmx (5-20) mm slab; and the finish being Ra6-Ra8, size (200-600) mmx (100-500) mmx (5-20) placing the envelope in mm of the slab, followed by the sealing, envelope coated slabs obtained;

Step three in the envelope is stainless steel, titanium or titanium alloy;

In the step three envelope has a thickness of 2 mm -20 mm;

Four, envelope rolling temperature: the envelope blank obtained in the third step into a furnace of the coated composition, and the furnace from room temperature to 1000 °C -1250 °C, and then at a temperature of 1000 °C-incubated 5min 1250 °C -120min, and the temperature is 1000 °C-coated capsule is placed in 1250 °C of the slab on a rolling mill, rolling rate of 0.01 m/s-2.5 m/s, pass deformation is 5%-40%, 30% total deformation rolling-pass back to the furnace temperature is 90% and the 1000 °C-at 1250 °C, incubating 5min-60min of rolling, the stock obtained; rolled at a temperature of 1000 °C and the placed-in furnace 1250 °C, again closes the furnace power supply, the stock to cool down to 100 °C -900 °C, and the temperature is 100 °C-pieces removed from the oven 900 °C, cooled to room temperature, with a rolled plate of the envelope to;

Five, removing the sheath:

Mechanical processing obtained in step four removal of the envelope with envelope of the rolled sheet, to give TiAl alloy sheet.

2. A beta-gamma TiAl TiAl a pre-alloyed powder preparation method of the alloy sheet material according to claim 1, characterized in a weighed 0.5 m particle size in step-325 m nominal chemical composition is Ti-(41-44) Al-(2-9) X-(0.1-1) Z (at %) of beta-gamma TiAl pre-alloyed powder.

3. A beta-gamma TiAl TiAl alloy sheet prepared pre-alloyed powder method according to claim 1, characterized in step a particle size 0.5 m is weighed-325 m nominal chemical composition is Ti-(42.5-43.5) Al-(2-9) X-(0.2-0.5) Z (at %) of beta-gamma TiAl pre-alloyed powder.

4. A beta-gamma TiAl pre-alloyed powder TiAl preparation method of the alloy sheet material according to claim 1, characterized in step a particle size of 0.5 m is weighed-325 m nominal chemical composition is Ti -43Al-9V-0.3Y (at %) of beta-gamma TiAl pre-alloyed powder.

5. A beta-gamma TiAl pre-alloyed powder TiAl method of preparing alloy sheet material according to claim 1, characterized in that in step two hot isostatic pressing treatment at a temperature of 1100 °C -1200 °C, a pressure of 140 mpa-160 mpa, time is 1.5h-2.5h.

6. A beta-gamma TiAl TiAl method of preparing pre-alloyed powder alloy sheet material according to claim 1, characterized in that in step two hot isostatic pressing treatment at a temperature of 1150 °C -1250 °C, a pressure of 140 mpa-180 mpa, time 1h is -2h.

7. A beta-gamma TiAl TiAl a pre-alloyed powder preparation method of the alloy sheet material according to claim 1, characterized in comprising the four steps of the envelope blank obtained in the third step are placed in a heating, from room temperature to 1150 °C and the furnace-1250 °C, and then at a temperature of 1150 °C-incubated 30min 1250 °C -90min, and the temperature is 1150 °C-coated capsule is placed in 1250 °C of the slab on a rolling mill, rolling rate of 0.01 m/s-0.4 m/s, pass deformation is 5%-25%, 40% total deformation rolling-pass back to the furnace temperature is 75% and the 1150 °C-at 1250 °C, incubating 5min-15 min is performed at the conditions, the stock obtained.

8. A beta-gamma TiAl TiAl alloy sheet prepared pre-alloyed powder method according to claim 1, characterized in step four envelope blank obtained in the third step are placed in a heating of the package, and the furnace from room temperature to 1180 °C -1250 °C, 1180 °C at a temperature of re-incubated 30min 1250 °C -120min, and the temperature is 1180 °C-coated capsule is placed in 1250 °C of the slab rolling machine, a rolling rate of 0.01 m/s-0.3 m/s, pass deformation is 6%-18%, 50% total deformation rolling-pass back to the furnace temperature is 80% and the 1180 °C-at 1250 °C, incubating 5min-10 min is performed at the conditions, the stock obtained.

Self straggle reaction connocting method of TiAl alloy and TiB2 metal ceramics CN1785913

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- **International Patent Classification**
  C04B-035/65 C04B-037/02
- **Publication Information**
  CN1785913 A 2006-06-14 [CN1785913]
- **Priority Details**
  2005CN-0010468 2005-10-25

- **Fampat family**

CN1785913	A	2006-06-14	[CN1785913]
CN1328222	C	2007-07-25	[CN1328222C]

- **Abstract:**
  (CN1785913)
  The present invention relates to a self-spreading reaction connection method of TiAl alloy and TiB2 metal ceramics, and relates to a welding method of TiAl alloy and TiB2 metal ceramics. Said method includes the following steps: using high-frequency electromagnetic field to preheat TiAl alloy and TiB2 metal ceramics; at the same time of applying high-frequency electromagnetic field applying axial pressure of 30-60MPa to overlapped alloy and metal ceramics and making the powder pressed briquette sandwiched between alloy and metal ceramics be ignited by high-frequency electromagnetic field and produce self-spreading reaction so as to implement connection of alloy and metal ceramics. The described powder pressed briquette is made up by uniformly mixing powders of Ti,Al,C,Ni and Mo and pressing them.

Claims

(CN1785913)

1. TiAl alloy with TiB2 self-propagating reaction connection method of the cermet, characterized in that it comprises the following steps: one, with high frequency electromagnetic field to the TiAl alloy and TiB2 metal ceramic glow; second, while applying a high frequency electromagnetic field to the stack of TiAl continued alloys and TiB2 cermet applied 30-60 mpa an axial pressure force, TiAl alloy is sandwiched with the TiB2 cermet powder between the self-propagating reaction takes place is struck and the green compacts are high-frequency electromagnetic fields, TiAl alloy to achieve TiB2 connection of the cermet, powder compacting by Ti, Al, C, and the Mo powder and uniformly mixed with Ni prepared by pressing or by Ti, Al, B, Ni and the Mo powder mixed with the mixture prepared by pressing.
2. TiAl alloy with TiB2 self-propagating reaction connection method of the cermet according to claim 1, characterized in powder compacting each weight percentage of components as: Ti: 27.5-45%, Al: 15-25%, C: 8-10%, Mo: 3-5%, the balance being Ni.
3. TiAl alloy with TiB2 self-propagating reaction of the cermet connecting method according to claim 1, characterized in powder compacting each weight percentage of components as: Ti: 22.5-40%, Al: 15-20%, B: 10-15%, Mo: 4-8%, the balance being Ni.
4. TiAl alloy with TiB2 self-propagating reaction connection method of the cermet according to claim 1, characterized in that it further comprises the steps of: three, continues to be applied to the stack of TiAl alloys and high-frequency electromagnetic field while TiB2 cermet applied 10-40 mpa an axial pressure force.
5. TiAl alloy with TiB2 self-propagating reaction connection method of the cermet according to claim 4, characterized in in a step three, high frequency induction heating to TiAl alloy with TiB2 cermet said connection fitting has a temperature of 1200-1300K, holding 40-60min, heating was then stopped, TiAl alloy and TiB2 cermet are released when pressure is decreased to 373K.
6. TiAl alloy with TiB2 self-propagating reaction connection method of the cermet according to claim 5, characterized in that the composition of the TiAl alloy to be welded: Ti-46.5Al-2.5V-1.0Cr (at %), TiB2 cermet composition is: TiB2-40Cu(wt%), respectively with the surfaces to be brazed 400#,500#,600#,800#,1000# metallurgical sandpaper burnishing step by step, and then using ultrasound sonication washer cleaning in an acetone solution, in accordance with Ti: 27.5-45%, Al: 15-25%, C: 8-10%, Mo: 3-5%, the balance being Ni ratio of the constituent powders were weighed out, the above components were mixed using a ball mill for 24 hours under argon powder, a ball mill with the ball-powder ratio of 5-10:1, with 400-500 mpa the powder is compressed into a powder compacting pressure in the axial direction; TiAl alloy and a high-frequency induction heating method to TiB2 metal-ceramic joint is heated to a melting point of the elements Al, upon completion of the workpiece is locally preheated reaction since compacts the spread processing simultaneous ignition of the powder, the powder of the compact self-propagating reaction is effected with the aid TiAl alloy applied electromagnetic field with the TiB2 preliminary attachment of the cermet, using high frequency induction heating is continued after initial connection of the equalization process is completed diffusion weldment, weld cools down after processing, end.
7. TiAl alloy with TiB2 self-propagating reaction connection method of the cermet according to claim 5, characterized in accordance with a weight percentage of Ti: 22.5-40%, Al: 15-20%, B: 10-15%,, Mo: 3-8%, the balance being Ni in the proportions of the original powder, using 300-400 mpa the thoroughly mixed raw powder is compressed to the pressure of the powder compact, self-propagating reaction was maintained during the connection 40-60 mpa an axial connection pressure.

Surface treating method for improving TiAl base alloy surface property
CN1676658

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- **International Patent Classification**
  C22C-014/00 C22C-021/00 C22F-001/00
- **Publication Information**
  CN1676658 A 2005-10-05 [CN1676658]
- **Priority Details**
  2005CN-0009907 2005-04-19

- **Fampat family**

CN1676658	A	2005-10-05	[CN1676658]
CN100400697	C	2008-07-09	[CN100400697C]

- **Abstract:**
  (CN1676658)
  This is a kind of surface handling method which can improve the surface performance of TiAl base alloy. It refers to a kind of method to treat the surface of TiAl base alloy containing large quantity of beta phase stable element. This invention puts this kind of alloy into the pot in which graphite or carbon included material is set as the heat-source material of hot isostatic apparatus, or it puts the alloy into the pot in which non-graphite or no-carbon included material is set as the heat-source material of hot isostatic apparatus. If the latter is chosen, 0.001-20000g graphite powder, carbon powder, carbon-included simple substance or compound should be put into it to make hot isostatic pressing surface treatment. The temperature during the treatment should be between 800-1500deg.C, while the pressure should be 1-300Mpa. It should take 1 minute-20 hours to keep warm during the hot isostatic pressing surface treatment. In a word, this invention uses the essential hot-working method to do the treatment, having the merits of little cost, easy realization and no need to increase additional device.

Claims
(CN1676658)
1. A method for improving the surface properties of the TiAl-based alloy surface treatment method, characterized in phase stabilizing elements of the solution containing a high content of a graphite or carbon-containing material TiAl based alloy was placed in a hot isostatic pressing apparatus as a heat source of the material of the crucible or into a non-carbonaceous material as a heat source in a non-graphite or hot isostatic pressing of the material in the crucible of the apparatus, in a non-carbonaceous material as a heat source in a non-graphite or hot isostatic pressing apparatus of the material of the crucible was added 0.001-20000g of the graphite powder, carbon powder, a carbon containing a simple substance or a carbon compound to hot isostatic pressing surface treatment, surface treatment using argon gas as a shielding gas in the process, the solution was heated while backfilled with argon, after reaching the surface of the temperature and pressure, so as to warm, natural cooling to room temperature reaches the temperature holding time may be followed by the crucible; hot isostatic pressing surface treatment has a temperature of 800-1500 °C, hot isostatic pressing surface disposed at a pressure of 1-300 mpa, hot isostatic pressing of the surface treatment 20 hours incubation period ranging from 1 minute to.
2. A method for improving the surface properties of the TiAl-based alloy surface processing method according to claim 1, characterized in graphite or carbon-containing material is a heat source material in a hot isostatic pressing apparatus of the crucible was added to 0.0001-10000g of the graphite powder, carbon powder, carbon containing a simple substance or a carbon containing compound to hot isostatic pressing surface treatment.
3. A method for improving the surface properties of the TiAl-based alloy surface processing method according to claim 1, characterized in TiAl-based alloy containing Ti content of 20-80at.%, Al content of 20-60at. %.
4. A method for improving the surface properties of the TiAl-based alloy surface processing method according to claim 1, characterized in phase stabilizing elements containing high levels of the TiAl-based alloy is: TiAl-based alloy having an atomic percent of phase stabilizing elements 2-15at %.
5. A method for improving the surface properties of the TiAl-based alloy surface processing method according to claim 1, characterized in TiAl-based alloys phase stabilizing elements are: Nb, V, Mo, Ta, Ni, Cr, Mn, Fe, Co, Cu or Si.
6. A method for improving the surface properties of the TiAl-based alloy surface processing method according to claim 1, characterized in hot isostatic pressing surface treatment has a temperature of 810-1430 °C, hot isostatic pressing surface disposed at a pressure of 5-290 mpa, hot isostatic pressing temperature holding time of 10 minutes to surface treatment of 19 hours.
7. A method for improving the surface properties of the TiAl-based alloy surface processing method according to claim 1, characterized in hot isostatic pressing surface treatment has a temperature of 860-1400 °C, hot isostatic pressing surface disposed at a pressure of 10-270 mpa, hot isostatic pressing temperature holding time of 30 minutes to 18 of the treated surface is small.
8. A method for improving the performance of the TiAl-based alloy surface surface treatment method according to claim 1, characterized in hot isostatic pressing surface treatment has a temperature of 1100 °C, hot isostatic pressing surface disposed at a pressure of 100 mpa, hot isostatic pressing temperature holding time of 5 hours of the processed surface.

Directional freeze method for TiAl-based alloy plate
CN1733391

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- **International Patent Classification**
  B22D-011/115
- **Publication Information**
  CN1733391 A 2006-02-15 [CN1733391]
- **Priority Details**
  2005CN-0010296 2005-09-02
- **Fampat family**

CN1733391	A	2006-02-15	[CN1733391]
CN100368121	C	2008-02-13	[CN100368121C]

- **Abstract:**
  (CN1733391)
  The continual casting directional solidification method for TiAl-base alloy plate comprises, putting TiAl alloy material bar 3 and dummy ingot 4 with rectangular intersection into the electromagnetic induction range of coil 6, galvanizing to coil 6 with single-phase alternating current with power of 75~100kW from electrical power for 20~25min; the alloy bar 3 and ingot 4 move downward with velocity of 0.01-0.05mm/min and get into the bottom crystallizer 8. This invention overcomes the limit to rectangular intersection blank and fits to press for high performance material in economy, science and national defense industry.

Claims

(CN1733391)

1. TiAl-based alloy plate pieces of the one directional solidification method, characterized in having the electromagnetic directional solidification to shape the electromagnetic constraints of the constraint functions to shape the directional solidification furnace (7) mounted within the molten alloy and controlling the magnetic field distribution with a constraint function of the cold crucible (5), the cold crucible (5) of the cavity (5-1-1) having a rectangular cross-section, in a cold crucible (5) is fixed to the outside of the 2-8 turn induction coil 6, then in a cold crucible (5) of the cavity (5-1-1) is provided within the upper end and the upper feed mechanism (1) fixation of the dummy (4) and a lower end and the lower pull mechanism (2) of the TiAl-based alloy rod may be fixedly connected (3), TiAl-based alloy rods (3) provided in the dummy (4) just above, the cavity (5-1-1) a wide (W), length (L), higH in a ratio of 1:2-6:10-20, in a cold crucible (5) of the crucible body (5-1) is provided with a uniform magnetic field distribution can be secured within the slotted crucible (5-6), the electromagnetic constraints to shape the directional solidification furnace (7) evacuated down to 0.005-0.1Pa, and then back-filled with argon to 2000-4000Pa, in the TiAl-based alloy rods (3) and the rectangular dummy (4) into the coil (6) after the sensing range of the magnetic field, the coil (6) into the single-phase AC power, power is applied power of 75-100 kw, residence 20-25 minutes later, TiAl-based alloy rods (3) and the rectangular dummy (4) to 0.01-0.05 mm/min speed of downward movement, and the material rod end thereof is provided on the lower mold (8) should be made.

2. TiAl-based alloy plate pieces one directional solidification method of according to claim 1, characterized in need to be an aspect ratio of (2-3) when a rectangular blank, the cavity (5-1-1) a wide (W), length (L), higH in a ratio of 1:2 .2-3.2: 10-15, coil (6) and the power of 75-90 kw single-phase power connection.

3. TiAl-based alloy plate pieces of the one directional solidification method according to claim 1, characterized in need to be an aspect ratio of 4-6 when the rectangular blank, the cavity (5-1-1) a wide (W), length (L), higH in a ratio of 1:4 .2-6.2: 16-20, the rectangular cold crucible (5) with the molds (8) is provided between the bi-layer molybdenum sheet liner alumina-silica fire-made insulating sleeve (10), coil (6) and the power of 90-100 kw single-phase power connection.

4. According to claim 1, 2 or 3 TiAl-based alloy plate pieces of the one directional solidification method, characterized in induction coil (6) into the single-phase alternating current has a frequency of 30-80kHz.

5. According to claim 1, 2 or 3 TiAl-based alloy plate pieces of the one directional solidification method, characterized in induction coil (6) includes an upper induction coil (6-1) and the lower induction coil (6-2), the upper induction coil (6-1) to 3-5 turns, into single-phase AC has a frequency of 30-40kHz, with power being applied to single-phase power supply 90-100 kw; lower induction coil (6-2) was 2-3 turns, into single-phase AC has a frequency of 70-80kHz, single-phase power source applies power to 75-90 kw.

6. TiAl-based alloy plate pieces of the one directional solidification method according to claim 5, characterized in need to be an aspect ratio of 2-3 when the rectangular blank, the cavity (5-1-1) a wide (W), length (L), higH in a ratio of 1:2 .2-3.2: 10-15, the upper induction coil (6-1) with a power of 80-90 kw single-phase power connection, the lower induction coil (6-2) and the power of 75-80 kw single-phase power connection.

7. One of the TiAl-based alloy plate pieces directional solidification method according to claim 5, characterized in need to be an aspect ratio of 4-6 when the rectangular blank, the cavity (5-1-1) a wide (W), length (L), higH in a ratio of 1:4 .2-6.2: 16-20, the rectangular cold crucible (5) with the molds (8) is provided between the jacket inner liner alumina-silica fire-fiber-made double-layered molybdenum sheet (10), the upper induction coil (6-1) with a power of 90-100 kw single-phase power connection, the lower induction coil (6-2) with a power of 80-90 kw single-phase power connection.

Gamma-TiAl intermetallic compound cast ingot with small full-lamellar microstructure and preparing method of gamma-TiAl intermetallic compound cast ingot

CN105039823

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- **International Patent Classification**
  C22C-001/03 C22C-030/00
- **Publication Information**
  CN105039823 A 2015-11-11 [CN105039823]
- **Priority Details**
  2015CN-0530970 2015-08-26
- **Fampat family**

CN105039823	A	2015-11-11	[CN105039823]

- **Abstract:**
  (CN105039823)
  The invention discloses a preparing method for a gamma-TiAl intermetallic compound cast ingot with a small full-lamellar microstructure, relates to the gamma-TiAl intermetallic compound cast ingot and the preparing method thereof, and provides the gamma-TiAl intermetallic compound cast ingot with the small full-lamellar microstructure and the preparing method of the gamma-TiAl intermetallic compound cast ingot with the small full-lamellar microstructure. The gamma-TiAl intermetallic compound cast ingot with the small full-lamellar microstructure is made of titanium sponge, high purity aluminum, aluminum niobium intermediate alloy, electrolytic chromium and TiB2 powder. The method comprises the steps that firstly, the titanium sponge, the high purity aluminum, the aluminum niobium intermediate alloy, the electrolytic chromium and the TiB2 powder are weighed; secondly, briquetting is carried out, and a metal pressing block is obtained; and thirdly, smelting, casting and cooling along with a furnace are carried out, and then the gamma-TiAl intermetallic compound cast ingot is obtained. The microscopic structure of the obtained gamma-TiAl intermetallic compound cast ingot is very small, the size of the lamellar colony is about 100 microns, and a formed TiB2 phase is evenly distributed in the organization. The preparing method and the gamma-TiAl intermetallic compound cast ingot are applied to the field of preparing of light heat-resistant high-temperature structural materials.

Claims

(CN105039823)

1. Having a fine full-ply tissue of a -TiAl intermetallic compound ingot, characterized in that full plies of tissue have fine -TiAl intermetallic compound Al: 46% by atomic percentage ratio of ingot-48%, Nb: 2%, Cr: 2%, TiB2:0.25%-0.5% and the balance of Ti, by the sponge titanium, a high-purity aluminum, aluminum and niobium master alloy, electrolytic chromium and TiB2 powder made.

2. Having a fine full-ply tissue of a -TiAl intermetallic compound process for the preparation of the ingot, characterized in that full plies of tissue have fine -TiAl intermetallic compounds which are prepared by ingot was done as follows:

One, the percentage ratio of Al: 46% by atoms per-48%, Nb: 2%, Cr: 2%, TiB2:0.25%-0.5% and the balance Ti, titanium sponge was separately weighed, high purity aluminum, aluminum and niobium master alloy, electrolytic chromium and TiB2 powder;

Second, the raw material is weighed by the step of a molded compact metal briquetting machine is carried out, each layer is a titanium sponge layer from bottom to top when the compact, high-purity aluminum layer, aluminum and niobium master alloy layer, electrolytic chromium layer, TiB2 powder layer and a titanium sponge layer, to obtain a metal compacts;

Three, water-cooled copper crucible induction melting furnace was preheated to metal mold 300-400 °C, and then the step will be derived in the water-cooled copper crucible induction melting furnace compacts into a metal, by applying vacuum to 1.0x10-3-3.0x10-3mbar, again at 10-15 kw/min rate the molten power was raised to 80-90 kw post-smelting 300-360s resulting melt, the melt is then cast into a preheated metal mold, and then furnace cooled, full plies of tissue to obtain an fine -TiAl intermetallic compound ingot;

Wherein, a purity of 99.7% titanium sponge mass, having a purity of 99.99% quality high-purity aluminum, aluminum and niobium having a purity of 99.8% by mass of master alloy, having a purity of 99.99% by mass of chromium electrolytically, TiB2 a purity of 99.99% by mass; respective raw materials are available commercially.

3. Fine tissue plies of a kind having an intermetallic compound of -tial full process for the preparation of the ingot according to claim 2, characterized in metal mold preheated to 350-400 °C in step three.

4. Having a fine full ply tissue of -tial process for the preparation of the ingot of intermetallic compounds according to claim 2, characterized in step three evacuated to 1.8x10-3-2.0x10-3mbar.

5. Full-ply tissue having a fine intermetallic compound of -tial process for the preparation of the ingot according to claim 2, characterized in step three to 10 kw/min rate was increased to 85-90 kw power the molten.

6. Full plies of tissue having a fine intermetallic compound -tial process for the preparation of the ingot according to claim 2, characterized in step three metal mold having a size of 50x60 mm.

One containing B, Y fine-grained TiAl alloy preparation method CN105369064

• **Patent Assignee** **HARBIN INSTITUTE OF TECHNOLOGY** • **International Patent Classification** C22C-001/03 C22C-014/00	• **Publication Information** CN105369064 A 2016-03-02 [CN105369064] • **Priority Details** 2015CN-0732369 2015-11-02
• **Fampat family** CN105369064 A 2016-03-02 [CN105369064]	

- **Abstract:**
  (CN105369064)
  Questel Machine translated AbstractContaining B, Y TiAl alloy preparation method of a fine-grained. The present invention relates to a method for producing a TiAl alloy. The present invention is intended to be solved through the addition of B, Y TiAl alloy structure is refined by the addition of creation elements too small amount does not reach the refining effect and too much a problem of poor performance at room temperature causes the alloy. Method: one, of the sponge titanium, aluminum ingots, alloying element X substance, boron and yttrium-aluminum master alloy compacts formed through metal briquette, the briquettes; second, will produce blocks placed in a water-cooled copper crucible to step one induction melting furnaces, the smelt to produce a melt; three, first the metal mold preheated, and then the resulting melt was cast into a preheated second step in the metal mold, the casting is completed with the furnace is cooled, to give a B, Y fine-grained TiAl alloy. The present invention slice group structure size fine product, the use of a TiAl alloy improves the performance, increased utilization of TiAl alloy, cost is reduced.

Claims

(CN105369064)

1. One containing B, Y fine-grained TiAl alloy preparation method, characterized in that the method is carried out in the following steps:

One, titanium sponge was, aluminum ingot, boron and yttrium-aluminum master alloy compacts formed through metal briquetting machine, the briquettes; titanium sponge ofthenniernulsion pressing block divided into two portions, a compact is from bottom to top of one of the titanium sponge for each layer, aluminum ingot, boron, yttrium aluminum master alloy and another portion of titanium sponge;

Second, the step of a water-cooled copper crucible induction melting to produce blocks placed in an oven, and then the water-cooled copper crucible vacuum induction melting furnace chamber was evacuated to 1.0 × 10-3 mbar~3.0 × 10-3 mbar, is then fed at a rate of 10 kw/min~15kW/min melting power raised to 85kW~90kW, and then the smelting 300s~360s 85kW~90kW a constant power, to produce a melt;

Third, the metal mold is first preheated to a temperature of 300 °C~400 °C, and then the step will be derived in the melt cast onto a preheated metal mold, followed by furnace cooling casting is completed, the method comprises # B, TiAl alloy fine-grained Y; containing B, TiAl alloy element in the Y fine-grained content of 43%~48% by atom of a Al, 0.1%~0.4% of a B, Y and the balance Ti 0.02%~0.2% to.

2. One containing B, TiAl alloy preparation of Y fine-grained method according to claim 1, characterized in purity of 99.7% step one in the mass of sponge titanium, aluminum ingot having a purity of 99.99% by mass, having a purity of 99.99% mass of boron powder, having a purity of 99.99% yttrium aluminum master alloys by mass.

3. One containing B, TiAl alloy preparation of Y fine-grained method according to claim 1, characterized in step two will be water-cooled copper crucible to produce blocks placed in step one of Al, and then the water-cooled copper crucible vacuum induction melting furnace chamber was evacuated to 1.8 × 10-3 mbar.

4. One containing B, TiAl alloy preparation of Y fine-grained method according to claim 1, characterized in the metal mold is first preheated in the third step to a temperature of 350 °C.

5. One containing B, Y fine-grained TiAl alloy preparation method, characterized in that the method is carried out in the following steps:

One, of the sponge titanium, aluminum ingot, a substance containing the element X, boron and yttrium-aluminum master alloy compacts formed through metal briquetting machine, the briquettes; compact ofthenniernulsion titanium sponge is divided into two parts, a compact is from bottom to top for each layer of one of the sponge titanium, aluminum ingot, a substance containing the element X, boron, yttrium aluminum master alloy and another portion of titanium sponge; containing the element X materials are aluminum and niobium master alloy, aluminum v master alloy, aluminum-molybdenum master alloy, tungsten powder, metallic iron and metallic chromium one or several, a substance containing the element X and the elements in the non-aluminum elements to X;

Second, the step of a water-cooled copper crucible induction melting to produce blocks placed in an oven, and then the water-cooled copper crucible vacuum induction melting furnace chamber was evacuated to 1.0 × 10-3 mbar~3.0 × 10-3 mbar, is then fed at a rate of 10 kw/min~15kW/min melting power raised to 85kW~90kW, and then the smelting 300s~360s 85kW~90kW a constant power, to produce a melt;

Third, the metal mold is first preheated to a temperature of 300 °C~400 °C, and then the step will be derived in the melt cast onto a preheated metal mold, followed by furnace cooling casting is completed, the method comprises # B, TiAl alloy fine-grained Y; containing B, TiAl alloy element in the Y fine-grained content of 43%~48% by atom of a Al, 0.01%~9% of element X, 0.1%~0.4% of a B, and the balance Ti 0.02%~0.2% of a Y.

6. One containing B, TiAl alloy preparation of Y fine-grained method according to claim 5, characterized in titanium sponge having a purity of 99.7% of a mass in the step one, aluminum ingot having a purity of 99.99% by mass, the mass of boron powder having a purity of 99.99%, yttrium aluminum master alloy having a purity of 99.99% by mass.

7. One containing B, TiAl alloy preparation method of fine Y according to claim 5, characterized in step one with a purity of 99.8% mass of aluminum and niobium in the master alloy, having a purity of 99.4% mass of aluminum v master alloy, having a purity of 99.2% by mass of master alloys of aluminum, tungsten powder having a purity of 99.9% by mass, having a purity of 99.9% mass of a metal iron, chromium having a purity of 99.9% mass of metal.

8. One containing B, TiAl alloy preparation of Y fine-grained method according to claim 5, characterized in step two will be water-cooled copper crucible to produce blocks placed in step one of Al, and then the water-cooled copper crucible vacuum induction melting furnace chamber was evacuated to 1.8 × 10-3 mbar.

9. One containing B, TiAl alloy preparation of Y fine-grained method according to claim 5, characterized in the metal mold is first preheated in the third step to a temperature of 350 °C.

A method for improving the conventional cast -TiAl alloy mechanical properties of multi-stage circulating a thermal processing method according to

CN105220096

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- **International Patent Classification**
  C22F-001/18

- **Publication Information**
  CN105220096 A 2016-01-06 [CN105220096]

- **Priority Details**
  2015CN-0741862 2015-11-04

- **Fampat family**

CN105220096	A	2016-01-06	[CN105220096]

- **Abstract:**
  (CN105220096)
  Questel Machine translated AbstractA method for improving conventional cast -TiAl alloy mechanical properties of a multi-step cycles through the heat treatment process. The present invention relates to a cast -TiAl alloy is a multi-step cycles through the heat treatment process. The purpose of the present invention is to solve the cast -TiAl alloy structure becomes coarse room temperatures, the problem of poor plasticity. One, the preparation of alloy; second, hot isostatic pressing treatment; three, homogenizing heat treatment; four, ₂ / phase spheroidizing heat treatment cycles; five, equiaxed heat treatment; six, ply/plies near full heat treatment. The present invention cycles through a multi-step heat treatment process is well controlled tissue evolution process, facilitate the plies of tissue is converted into a fine equiaxed structure coarse, effectively improve the -TiAl alloy at room temperature properties, elongation of the present invention alloys processed through 1.9-2.3%, yield strength of 430-450 mpa, breaking strength 540-570 mpa, TiAl alloy aerospace application fully meet the criteria.

Claims

(CN105220096)

1. A method for improving conventional cast -TiAl alloy mechanical properties of multi-stage circulating heat treatment method, characterized in the method is carried out in the following steps:

One, the preparation of an alloy: titanium sponge was, aluminum ingot, containing the element X species and the water-cooled copper crucible melter pure yttrium is placed in a vacuum melting is performed, after which the alloy melts the melt is maintained to be 10min-20min, the melt is then cast onto a rod type shells, sand blasting the whitened, before heat treatment to obtain -TiAl alloy; a substance containing the element X is an aluminum alloy or aluminum alloy and a mixture of pure Cr, wherein the aluminum alloy is Al-Nb master alloy, Al-V master alloy and Al-Mn of one or several kinds among, a substance containing the element X and the non-aluminum elements in the element X as; before heat treating -TiAl alloy element in the content of Ti-(46-48) Al-(0-4) X -0.05Y (at %), rod type shell before pouring at a temperature of 600-800 °C of incubating 2h-5h is dried;

Second, hot isostatic pressing process: step one obtained before heat treatment of the -TiAl alloy placed in hot isostatic pressing furnace, under argon atmosphere, at a pressure of 140 mpa-180 mpa and a temperature of 1240-1300 °C of incubating dwell 2h-6h, obtained after hot isostatic pressing treatment of a -TiAl alloy;

Three, a homogenization heat treatment: the step will be derived after hot isostatic pressing treatment -TiAl alloy placed in a vacuum tube heat-treating oven, under argon atmosphere, at a temperature raising rate was 12 °C/min-20 °C/min from room temperature to a temperature of 1380 °C -1400 °C, and then at a temperature of 1380 °C -1400 °C of incubating 30min-90min, anymore with the furnace cooled to room temperature, to obtain a homogenization heat treated -TiAl alloy;

Four, 2 / phase spheroidizing heat treatment cycle: the step three resulting homogenization heat-treated -TiAl alloy placed in a vacuum tube heat treatment furnace for 2 / phase spheroidizing heat treatment cycle, 2 / phase spheroidizing heat treatment process to cycle through :-1 at a temperature raising rate was 12 °C/min-20 °C/min from room temperature to a temperature of 1150-1200 °C, and then at a temperature of 1150-1200 °C of incubating 2h-4h ;-2 with furnace cooled to a temperature of 900-1000 °C, and at a temperature of 900-1000 °C of incubating 4h-8h ;-3 repeating steps-1 and the-2 operation 10-16 times, with the furnace is then cooled to room temperature, to give 2 / phase spheroidizing circulating heat-treated -TiAl alloy;

Five, equiaxed heat treatment: the step four resulting 2 / phase spheroidizing cycle heat treated -TiAl alloy placed in a vacuum tube heat treatment furnace, at a temperature raising rate was 12 °C/min-20 °C/min from room temperature to a temperature of 1120-1160 °C, and then at a temperature of 1120-1160 °C of incubating 100h-150h, continuously at a heating rate of 12 °C/min-20 °C/min by the temperature of 1120-1160 °C is warmed to a temperature of 1240-1270 °C, and then at a temperature of 1240-1270 °C of incubating 4h-8h, the oven was cooled to room temperature, to give equiaxed heat-treated -TiAl alloy;

Six, the proximal sheet/full ply heat treatment: the step five resulting equiaxed heat-treated -TiAl alloy placed in a vacuum tube heat treatment furnace, at a temperature raising rate was 12 °C/min-20 °C/min from room temperature to a temperature of 1340-1370 °C, and then at a temperature of 1340-1370 °C of incubating 20min-120min, furnace cooling to room temperature, to obtain heat-treated -TiAl alloy.

2. A method for improving conventional cast -TiAl alloy mechanical properties of multi-stage circulating heat treatment method according to claim 1, characterized in step one sponge titanium to titanium sponge stage 0, and a purity99.9 wt. %.

3. A method for improving conventional casting a multi-step cycle -TiAl alloy mechanical properties heat treatment method according to claim 1, characterized in step one aluminum ingot purity99.99 wt. %.

4. A method for improving conventional casting a multi-step cycle -TiAl alloy mechanical properties heat treatment method according to claim 1, characterized in step one containing the element X in the content of a substance in an aluminum alloy for the aluminum alloy element X amount of 50 wt % -80 wt. %.

5. A method for improving conventional cast -TiAl alloy mechanical properties of multi-stage circulating heat treatment method according to claim 4, characterized in step in step two of -TiAl upon harvesting the prior to heat treatment in a hot isostatic pressing furnace alloy was placed, under argon atmosphere, at a pressure of 160 mpa and a temperature of 1260 °C of incubating dwell 4h, obtained after -TiAl alloy hot isostatic pressing treatment.

6. A method for improving conventional casting -TiAl alloy mechanical properties of multi-stage circulating heat treatment method according to claim 1, characterized in step four -1 12 °C/min at a temperature rising speed is increased from room temperature to a temperature of 1170 °C, followed by incubation at a temperature of 1170 °C 4h.

7. -TiAl alloy casting a method for improving conventional mechanical properties of multi-stage circulating heat treatment method according to claim 1, characterized in step four -2 with furnace cooled to a temperature of 950 °C, and is incubated under conditions at a temperature of 950 °C to 6h.

8. A method for improving conventional casting -TiAl alloy mechanical properties of multi-stage circulating heat treatment method according to claim 1, characterized in step five of step four resulting 2 / phase consisting of -TiAl alloy after spheroidizing heat treatment cycles through vacuum tube placed in a heat treatment furnace, at a temperature raising rate was 12 °C/min from room temperature to a temperature of 1160 °C, followed by incubation at a temperature of 1160 °C 120h, 12 °C/min at a temperature rising speed is continued by the temperature is raised to a temperature of 1260 °C 1160 °C, followed by incubation at a temperature of 1260 °C 8h, the oven was cooled to room temperature, -TiAl alloy equiaxed obtained after heat treatment.

9. A method for improving conventional casting -TiAl alloy mechanical properties of multi-stage circulating heat treatment method according to claim 1, characterized in step six step five resulting equiaxed -TiAl alloy placed in a vacuum tube heat treatment after the heat treatment furnace, at a temperature raising rate was 12 °C/min from room temperature to a temperature of 1340 °C, followed by incubation at a temperature of 1340 °C 30min, furnace cooling to room temperature, -TiAl alloy obtained after heat treatment.

10. A method for improving conventional casting -TiAl alloy mechanical properties of multi-stage circulating heat treatment method according to claim 1, characterized in step six step five resulting equiaxed -TiAl alloy placed in a vacuum tube heat treatment after the heat treatment furnace, at a temperature raising rate was 12 °C/min from room temperature to a temperature of 1370 °C, followed by incubation at a temperature of 1370 °C 30min, furnace cooling to room temperature, -TiAl alloy obtained after heat treatment.

TiAl alloy is investment cast tungsten-containing one high inert-type method for producing a shell

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- **International Patent Classification**
  B22C-003/00 B22C-009/04
- **Publication Information**
  CN105195674 A 2015-12-30 [CN105195674]
- **Priority Details**
  2015CN-0732361 2015-11-02
- **Fampat family**

CN105195674	A	2015-12-30	[CN105195674]

- **Abstract:**
  (CN105195674)
  Questel Machine translated AbstractTiAl alloy is investment cast tungsten-containing one high inert-type shell production process. The present invention relates to a method for producing TiAl alloy foundry shell investment. The purpose of the present invention is to solve the high cost of the ceramic shell TiAl alloy investment casting, the casting surface and interfacial reaction sticky sand thicker serious problems. Method: one, the formulation of a face stock; second, sheet-type preparation of the shell; three, preparation of the back-layered shell; four, slurry seal; five, dewaxing and burning. The present invention is an ammonium tungstate sol was added low -cost Al₂ O₃ powder, after the lapse of a firing process, generates a high inert refractory material, TiAl alloy significantly lower interfacial reaction degree of investment casting, investment casting TiAl alloy to reduce the cost, the purpose of reducing the interface reaction. The present invention casting molds made glossy surface, which is not significantly sticky, the interface reaction layer thickness is about 20 m, as compared with the conventional case be greatly improved.

Claims
(CN105195674)
1. TiAl alloy investment casting the tungsten-containing one inert-type shell process for preparing high, characterized in the method is carried out in the following steps:
One, the formulation of a face stock: at a stirring speed of 20r/min-40r/min under the conditions of a defoamer was added to the ammonium tungstate sol and a wetting agent, to obtain a mixture, and then at an addition rate was 200g/min-300g/min to the resulting mixture were added Al2 O3 powder, at a stirring speed of 20r/min-40r/min under conditions of stirring and mixing to Al2 O3 powder uniformly dispersed in the mixture, and then at a stirring speed of 80r/min-100r/min with stirring under a 22h-24h, further left for 8h-12h, give the face stock;
Al2 O3 powder and ammonium tungstate sol at a mass ratio (2.5-3): 1; ammonium tungstate sol with a defoaming agent mass ratio of 100: (0.05-0.2); ammonium tungstate sol and the wetting agent mass ratio of 100: (0.05-0.2);
Second, sheet-type shell was prepared: a wax model is immersed in a face coat slurry obtained in the first step, rotating the pattern so that wax mold surface is fully coated face stock, and then coated with a layer slurry lifting of wax, and subjected to multi -axis rotation, while rotating in the top ply with rainfall sanding machine which is coated with a layer of wax model pour evenly distributing slurry having a particle size of 80 to object surface Al2 O3 sand, then transferred to a thermo-hygrostat was allowed to dry 22h-24h, giving top-type housing;
Constant temperature and humidity parameters are: temperature of 25 °C, a humidity of 50%-60%;
Three, back-layered shell was prepared: at a stirring speed of 20r/min-40r/min under the conditions of the silica sol was added at a rate to at 200g/min-300g/min was added diatomaceous earth, and then at a stirring speed of 40r/min-60r/min with stirring under a mixed 6h, resulting slurry having a back layer, and then the step will be derived in the top ply backing shell is immersed in a slurry type, surface type shell surface of the shell-type top ply is completely rotated back layer slurry was coated, after which the coated top ply-type shell lifted with a back layer of a slurry, followed by a multi-axis rotation, while rotating the coating surface type rainfall sanding machine with a back layer with uniform shell surface 60 mesh mullite slurry Spread a layer of cream, then transferred to a thermo-hygrostat was allowed to dry 22h-24h, give the back layer type shell;
Silica sols with diatomaceous earth mass ratio of 1: (1.6-2.2);
Constant temperature and humidity parameters are: temperature of 25 °C, a humidity of 50%-60%;
Four, slurry seal: 3 obtained by the step three times to obtain back layer type shells of the back layer sanding operation, and then the dried back-layered shell is immersed in the slurry in the back layer in the third step, turning back the back shell layered shell completely by the backing layer-type slurry was coated, after which the coated slurry having a back-layered shell lifted with a back layer, at constant temperature and humidity was allowed to dry 45h-50h, slurry seal coat obtained after;
The method comprises the sanding back layer: the step three the resulting back-layered shells of the multi-axis rotation, while rotating the entire surface of shell back layer type employed in the rainfall sanding machine 60 mesh mullite Spread a layer of cream, then transferred to a thermo-hygrostat was allowed to dry 22h-24h;
Constant temperature and humidity parameters are: temperature of 25 °C, a humidity of 50%-60%;
Five, dewaxing and burning: after the step four resulting slurry seal molds made by steam dewaxing, dewaxing pressure of 0.5 mpa-0.7 mpa, dewaxing time of 6min-10min, will be placed in a high-temperature heating of the oven muffle furnace dewaxing completed molds to a temperature of 200 °C, and is incubated at a temperature of 200 °C 2h, further increasing the temperature to a temperature of 500 °C, and is incubated at a temperature of 500 °C 2h, and then elevated to a temperature of 900 °C, and is incubated at a temperature of 900 °C 2h, complete firing, TiAl alloy to obtain high investment casting shell an inert type of tungsten.
2. TiAl alloy investment casting one tungsten-containing high inert-type shell production method according to claim 1, characterized in step one Al2 O3 powder having a size of 320 mesh.
3. TiAl alloy investment casting the tungsten-containing one inert-type shell process for preparing high according to claim 1, characterized in step one Al2 O3 powder and ammonium tungstate sol mass ratio of 2.6: 1
4. TiAl alloy investment casting one tungsten-containing high inert-type shell production method according to claim 1, characterized in step one defoamer is a silicone anti-foaming agents.
5. The tungsten-containing TiAl alloy one investment casting method for producing a high inert-type housing according to claim 1, characterized in step one the wetting agent was JFC.
6. TiAl alloy investment casting the tungsten-containing one inert-type shell process for preparing high according to claim 1, characterized in step one as to form a sol with a defoaming agent mass ratio of 100:0 .1.
7. TiAl alloy is a tungsten-containing inert-type shell process for preparing high investment casting according to claim 1, characterized in step one as to form a sol and the wetting agent mass ratio of 100:0 .125.
8. TiAl alloy investment casting one tungsten-containing high inert-type shell production method according to claim 1, characterized in step four silica sol with diatomaceous earth mass ratio of 1:2 .0.

TiAl alloy sheet processing method according to one vacuum extrusion CN105132842

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- **International Patent Classification**
  C22C-001/04 C22F-001/18
- **Publication Information**
  CN105132842 A 2015-12-09 [CN105132842]
- **Priority Details**
  2015CN-0683864 2015-10-20

- **Fampat family**

CN105132842	A	2015-12-09	[CN105132842]

- **Abstract:**
  (CN105132842)
  Questel Machine translated AbstractTiAl alloy sheet processing method according to one vacuum extrusion, TiAl alloy sheet processing method according to one. The present invention is to solve the technical problem of difficulty in forming TiAl alloy existing. The present invention: one, TiAl powder prepared; second, prealloyed TiAl powder; three, vacuum hot press sintering; four, TiAl alloy sheet extrusion. The present invention by first pre-alloyed, TiAl alloy vacuum hot press sintering method to obtain a block of material, and then the block is placed in the extrusion die extrusion molding is carried out in aUoy high temperature. An advantage of the present invention: the present invention provides TiAl alloy plate pressing one of the vacuum processing method of a TiAl alloy because of its ductility at room temperature difference is solved, the problem of high-temperature strength due to the difficulty in forming, TiAl alloy sheet obtained by high temperature extrusion process. The method of the present invention are equally applicable to other titanium alloy materials.

Claims
(CN105132842)
1. TiAl alloy sheet material processing method of vacuum pressing one, characterized in TiAl alloy sheet vacuum extrusion processing method is carried out in the following steps:
One, TiAl powder prepared: 1:1 molar ratio of the titanium powder and aluminum powder mix flour milling machine for milling mixing in accordance with placed in 6h, TiAl to form a homogeneous powder mixture;
Second, a prealloyed TiAl powder: a first step of the resulting uniform mixed powder was placed in a tube furnace under vacuum or TiAl argon under a condition 0.3 °C/min-0.5 °C/min from room temperature to a heating rate of 550 °C -900 °C, then in a vacuum or an atmosphere of argon and a temperature of 550 °C -900 °C of incubating 1h-2h, to obtain a pre-alloyed powder TiAl;
Three, vacuum hot press sintering: TiAl powder obtained by step two pre-alloyed graphite filled in between upper and lower punches of a mold, compacted installed furnace, the furnace was evacuated to vacuum reaches 10-2 Pa-10-3 Pa,a vacuum degree of 10-2 Pa-10-3 Pafrom room temperature to 630 °C under conditions, then applying a compressive pressure of 20 mpa, a vacuum degree of 10-2 Pa-10-3 Pa,temperature of 630 °C and pressing pressure was 20 mpa 1h incubation, then under vacuum and pressing at a pressure of 20 mpa 630 °C under conditions of warmed to a temperature of from 1150 °C -1300 °C, in a vacuum, the compression pressure is 30 mpa-50 mpa and a temperature of 1150 °C -1300 °C of incubating 90min-120min, naturally cooled to room temperature, TiAl alloy block obtained;
Four, TiAl alloy sheet extrusion: TiAl alloy block obtained in step three applying a lubricant surface, then place in the extrusion die, the extrusion temperature of 1250 °C -1350 °C, pressing pressure of 50 mpa-80 mpa and a vacuum of incubating 1h, TiAl alloy sheet material was obtained.
2. TiAl alloy sheet material processing method according to one vacuum press according to claim 1, characterized in anhydrous ethanol mix flour milling is employed in the first step is a hybrid medium, anhydrous ethanol 10% -30% titanium powder and aluminum powder a mass of the total mass of.
3. TiAl alloy sheet material processing method according to one vacuum press according to claim 1, characterized in titanium powder having a purity of 99.5% in step one.
4. TiAl alloy sheet material processing method of vacuum pressing one according to claim 1, characterized in step one aluminum powder having a purity of 99.7%.
5. TiAl alloy sheet material processing method according to one vacuum press according to claim 1, characterized in step four lubncants boron nitride.
6. TiAl alloy sheet material processing method of vacuum pressing one according to claim 1, characterized in step four extrusion die is made of graphite material, graphite material 110 mpa compressive strength.

TiAl/Ti alloy layered composite sheet is prepared for powder metallurgy process according to

CN105108156

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  B22F-003/105 B22F-007/02
- **Publication Information**
  CN105108156 A 2015-12-02 [CN105108156]
- **Priority Details**
  2015CN-0589629 2015-09-16

- **Fampat family**

CN105108156	A	2015-12-02	[CN105108156]

- **Abstract:**
  (CN105108156)
  Questel Machine translated AbstractTiAl/Ti alloy layered composite sheet is prepared for powder metallurgy method, it relates to a TiAl/Ti alloy layered composite sheet method of powder-metallurgically produced. The present invention is a method of: preparing a raw material; spark plasma sintering; cutting machining; stacked slab; envelope; the envelope rolling temperature; removal of the sheath; composite sheet obtained by the present invention has a size of 230 mm x80 mm x1.2 mm, a tensile strength of up to 1200 mpa at room temperature, room temperature plastic to 4-5%. The tensile strength of up to 900 mpa 700 °C, plastic 700 °C for 10-15%.

Claims

(CN105108156)

1. One method of powder-metallurgically produced laminated composite plate materials TiAl/Ti alloy, characterized in that it is completed in the following steps:

One, the raw material preparation: weighing the particle diameter of 0.5 m -250 m a nominal chemical composition is Ti-(40-44.5) Al-(0.5-10) X-(0.1-2) Z (at %) of a prealloyed powders TiAl, weighing the particle diameter of 0.5 m -250 m made of pure titanium or a titanium alloy prealloyed powders;

Wherein, X is a beta phase stabilization element, Z is a micro alloying elements;

The nominal chemical composition is Ti-(40-44.5) Al-(0.5-10) X-(0.1-2) Z (at %) of a pre-TiAl alloy powder is made by inert gas atomization or rotating electrode method prepared atomizing method;

Pure titanium or a titanium alloy pre-alloyed powder is atomized by inert gas atomization method or rotating electrode method prepared;

Second, spark plasma sintering process: step one was weighed in a particle diameter of 0.5 m -250 m a nominal chemical composition is Ti-(40-44.5) Al-(0.5-10) X-(0.1-2) Z (at %) of a pre-alloyed powder into a graphite vessel TiAl, vacuum degassing, spark plasma sintering process is carried out, to give the denseness of 95%-100% of a TiAl alloy slab;

Three, will step one weighing particle diameter of 0.5 m -250 m made of pure titanium or a titanium alloy prealloyed powders placed in a graphite vessel, vacuum degassing, spark plasma sintering process is carried out, to give the denseness of 95%-100% pure titanium or a titanium alloy slab;

In step two and step three vacuum degassing temperatures are in room temperature, vacuum was held at 0.01-1 Pa;

In step two and step three spark plasma sintering process are a heating rate of 10 °C/min-200 °C/min;

In step two and step three spark plasma sintering temperatures are in 900 °C -1400 °C, a pressure of 5 mpa-100 mpa, incubation period was 2min-180min, after incubation with furnace cooled;

Four, a cutting process: TiAl alloy and pure titanium or a titanium alloy slab of the resulting slabs were wire cutting and corner rounding, surface finish are obtained Ra6-Ra8, aspect are (10-200) mmx (10-200) mm and the thickness of TiAl alloy of pure titanium or a titanium alloy slab and prefabricated 0.3-30 mm of a prefabricated slab;

Five, the envelope: TiAl alloy preform will step four prefabricated slabs were stacked pure titanium or a titanium alloy slab and; stacking scheme is: TiAl alloy/pure titanium or a titanium alloy slab to slab prefabricated pre-TiAl alloy preform in a manner of pure titanium or a titanium alloy slab and alternately stacked pre-slab to 2n + 1 layer, to obtain a final stacked slab; wherein, n is a 1-50 an integer; TiAl alloy preform final stacked slabs at two sides of the slab;

The final stacked slab is placed within the capsule, followed by a seal;

Six, high temperature capsule rolling: the step five resulting sealed envelope of a post-weld placed in a heating furnace, and the heating furnace from room temperature to 1000 °C -1350 °C, again at a temperature of 1000 °C -1350 °C retained for 5min-120min, and then the capsule is placed on the side of the mill, the rolling rate of 0.01 m/s-2.5 m/s, stress concentrates to pass 5%-40%, the rolling total deformation of 30%-90% and a pass to the furnace temperature was 1000 °C -1350 °C, the incubation time was 5min-60min rolling was carried out, to give the workpiece; and the workpiece is placed at a temperature of 1000 °C -1350 °C in an oven, furnace power is turned off, subject to rolling naturally cooled to 100 °C -600 °C, and then the workpiece is removed from the oven, allowed to cool to room temperature, and obtaining packet a sheathed steel;

Seventh, removing the sheath:

Is removed by mechanical processing method obtained in step six pack having encased in a sheath of a material to be rolled, TiAl/Ti alloy layered composite sheet is obtained.

2. TiAl/Ti alloy layered composite plate materials for powder metallurgy method of preparation according to claim 1, characterized in beta phase-stable element is Mo, Cr, Nb, V, W, Fe and the Mn and mixtures and one of mixing.

3. TiAl/Ti alloy layered composite plate materials for powder metallurgy method of preparation according to claim 1, characterized in micro alloying element is B, C and the Y one of or a combination.

4. TiAl/Ti alloy layered composite plate materials for powder metallurgy method of preparation according to claim 1, characterized in steps two and three in the vacuum degassing temperatures are in room temperature, vacuum was held at 0.05-1 Pa.

5. TiAl/Ti alloy powder metallurgy method of preparing a layered composite sheet material according to claim 1, characterized in spark plasma sintering process in the steps two and three are 20 °C/min-200 °C/min rate of temperature increase of.

6. TiAl/Ti alloy layered composite plate materials for powder metallurgy method of preparation according to claim 1, characterized in steps two and three in the spark plasma sintering temperatures are in 1000 °C -1400 °C, a pressure of 30 mpa -100 mpa, incubation period was 2min-120min, after incubation with furnace cooled.

7. TiAl/Ti alloy layered composite plate materials for powder metallurgy method of preparation according to claim 1, characterized in sheath is made of stainless steel, pure titanium or a titanium alloy.

8. TiAl/Ti alloy layered composite plate materials for powder metallurgy method of preparation according to claim 1, characterized in step six high-temperature envelope obtained by the step five rolling is placed in a heating furnace envelope of a post-weld seal, and the heating furnace from room temperature to 1000 °C -1350 °C, and then incubated at a temperature of 1000 °C -1350 °C 5min-100min, and then the capsule is placed on the side of the mill, the rolling rate of 0.05m/s-2 /s, 5% -40% amount of the flow pass, and the total deformation of 30% -90% rolling pass to the furnace temperature of 1000 °C -1350 °C, the incubation time was performed under conditions of 5min-50min rolling, the rolled pieces obtained; and the material to be rolled at a temperature of 1000 °C -1350 °C placed in an oven, furnace power is turned off, naturally cooled to 120 °C -600 °C subject to rolling, and then the workpiece is removed from the oven, allowed to cool to room temperature, and obtaining packet a sheathed steel.

9. TiAl/Ti alloy layered composite plate materials for powder metallurgy method of preparation according to claim 8, characterized in step six high-temperature envelope rolling is placed in the step five resulting sealed envelope of a post weld heating furnace, and the heating furnace from room temperature to 1000 °C -1350 °C, and then incubated at a temperature of 1000 °C -1350 °C 5min-80min, and then the capsule is placed on the side of the mill, the rolling rate of 0.1m/s-2 /s, 5% -40% amount of the flow pass, and the total deformation of 30% -90% rolling temperature of 1000 °C -1350 °C pass to the furnace, the incubation time was

performed under conditions of 5min-45min rolling, the rolled pieces obtained; and the material to be rolled at a temperature of 1000 °C -1350 °C placed in an oven, furnace power is turned off, subject to rolling a natural cooling to 150 °C -600 °C, and then the workpiece is removed from the oven, allowed to cool to room temperature, and obtaining packet a sheathed steel.

10. TiAl/Ti alloy layered composite plate materials for powder metallurgy method of preparation according to claim 9, characterized in step six high-temperature envelope obtained by the step five rolling is placed in a heating furnace envelope of a post-weld seal, and the heating furnace from room temperature to 1000 °C -1350 °C, and then incubated at a temperature of 1000 °C -1350 °C 5min-75min, and then the capsule is placed on the side of the mill, the rolling rate of 0.1m/s-2 /s, 5% -40% amount of the flow pass, and the total deformation of 30% -90% rolling pass to the furnace temperature of 1000 °C -1350 °C, the incubation time was performed under conditions of 5min-40min rolling, the rolled pieces obtained; and the material to be rolled at a temperature of 1000 °C -1350 °C placed in an oven, furnace power is turned off, cooled to 180 °C -600 °C naturally subject to rolling, and then the workpiece is removed from the oven, allowed to cool to room temperature, and obtaining packet a sheathed steel.

Method for preparing TiAl/Ti alloy laminated composite board through spark plasma sintering and pack hot rolling

CN105081323

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- **International Patent Classification**
  B22F-003/105 B22F-003/18 B22F-007/02 C22C-014/00
- **Publication Information**
  CN105081323 A 2015-11-25 [CN105081323]
- **Priority Details**
  2015CN-0589682 2015-09-16

- **Fampat family**
  CN105081323 A 2015-11-25 [CN105081323]

- **Abstract:**
  (CN105081323)
  The invention discloses a method for preparing a TiAl/Ti alloy laminated composite board through spark plasma sintering and pack hot rolling, and relates to the method for preparing the TiAl/Ti alloy laminated composite board. The method aims at solving the problems that in a board rolling process, a material is prone to cracking, not high in strength and low in room temperature ductility. The method comprises the steps of raw material preparation, spark plasma sintering, cutting machining, pack operation, high-temperature pack rolling and pack removing, and therefore the TiAl/Ti alloy laminated composite board is obtained. The room temperature tensile strength of the obtained TiAl/Ti alloy laminated composite board can reach 1200MPa, the room-temperature ductility ranges from 4% to 5%, the 700-DEG C tensile strength can reach 900 MPa, and the 700-DEG C ductility ranges from 13% to 19%. The method for preparing the TiAl/Ti alloy laminated composite board through spark plasma sintering and pack hot rolling can be obtained.

Claims

(CN105081323)

1. One spark plasma sintering and the TiAl/Ti alloy layered composite sheet material envelope hot rolling method of preparation, characterized in one spark plasma sintering and a bag TiAl/Ti alloy layered composite sheet hot rolling method of preparing a sleeve by the following steps are performed:
One, the raw material preparation: weighing the particle diameter of 0.5 m -250 m a nominal chemical composition is Ti-(40-44.5) Al-(0.5-10) X-(0.1-2) Z (at %) of a prealloyed TiAl powder; preparing pure titanium plate or a titanium alloy plate;
Step one Ti-(40-44.5) Al-(0.5-10) X-(0.1-2) Z (at %) in the beta phase stabilization element to X, Z is a micro alloying elements;
Step one nominal chemical composition is Ti-(40-44.5) Al-(0.5-10) X-(0.1-2) Z (at %) of a pre-alloyed powder is made by inert gas atomization TiAl or plasma rotating electrode atomization techniques from the art;
Second, spark plasma sintering process: step one is weighed particle diameter of 0.5 m -250 m a nominal chemical composition is Ti-(40-44.5) Al-(0.5-10) X-(0.1-2) Z (at %) of a prealloyed TiAl powder into a graphite mold, vacuum degassing, spark plasma sintering process is carried out, to give the denseness of 95%-100% of a TiAl alloy slab;
In step two vacuum degassing temperature is room temperature, vacuum degree of 0.01-1 Pa;
In step two spark plasma sintering a heating rate of 20 °C/min-200 °C/min;
In step two spark plasma sintering at a temperature of 900 °C -1400 °C, a pressure of 5 mpa-100 mpa, temperature holding time of 2min-180min, after incubation with furnace cooled;
Three, a cutting process:
In step two resulting denseness of 95%-100% TiAl alloy slab prepared in step one of a pure titanium sheet or titanium alloy and the plate was subjected to wire cutting and corner rounding, surface finish are obtained Ra6-Ra8 TiAl alloy and pure titanium or a titanium alloy prefabricated precast slab of a slab;
TiAl alloy preform in step three pure titanium or a titanium alloy slab and said prefabricated slabs are of equal size, TiAl alloy and pure titanium or a titanium alloy prefabricated precast slab and the slab having a length of 10 mm -200 mm, a width of 10 mm -200 mm, thickness of 0.3 mm -30 mm;
Four, the envelope:
TiAl alloy preform obtained in the step three pure titanium or a titanium alloy slab and prefabricated slabs were stacked; stacking scheme is: TiAl alloy preform to pure titanium or a titanium alloy slab/TiAl alloy preform prefabricated slabs in a manner of pure titanium or a titanium alloy slab and alternately stacked precast slab to 2n + 1 layer, to obtain a final stacked slab; wherein, n is a 1 -50 an integer; TiAl alloy preform into the final stacked slab on both sides of the slab; the final stacked slab is placed within the capsule, followed by a seal;
In step four the sheath is stainless steel, pure titanium or a titanium alloy;
Five, high temperature capsule rolling: obtained in the step four envelope of a post-weld seal placed in a heating furnace, and the heating furnace from room temperature to 1000 °C -1350 °C, again at a temperature of 1000 °C -1350 °C retained for 5min-120min, and then the capsule is placed on the side of the mill, and then at a rolling rate of 0.01 m/s-2.5 m/s, stress concentrates to pass 5%-40%, the rolling total deformation of 30%-90% and a pass to the furnace temperature was 1000 °C -1350 °C retained for 5min-60min rolling was carried out, to give the workpiece; and the workpiece is placed at a temperature of 1000 °C -1350 °C in a heating oven, again closes the furnace power, the product is naturally cooled to 100 °C -600 °C, and the temperature of 100 °C -600 °C the product is taken out from the oven, allowed to cool to room temperature, and obtaining packet a sheathed steel;
Sixth, removing the sheath:
By mechanical processing method according to a fifth step of removing the outer envelope of a package of a rolled the capsule to be obtained, TiAl/Ti alloy layered composite sheet was obtained.
2. Claim 1 A according to spark plasma sintering process and the TiAl/Ti alloy layered composite sheet material envelope hot rolling method of preparation, characterized in step one beta phase-stable element is Mo, Cr, Nb, V, W, Fe and the Mn and mixtures and mixed one.
3. Claim 1 A according to spark plasma sintering process and the hot-rolled alloy layered composite sheet material envelope method of preparing a TiAl/Ti, characterized in step one micro alloying element is B, C and a mixture of several kinds of one or Y.
4. Claim 1 A according to spark plasma sintering process and the hot-rolled alloy layered composite sheet material envelope method of preparing a TiAl/Ti, characterized in step two vacuum degassing temperature is room temperature, vacuum degree of 0.05-1 Pa.
5. Claim 1 A according to spark plasma sintering process and the TiAl/Ti alloy layered composite sheet material envelope hot rolling method of preparation, characterized in step two spark plasma sintering a heating rate of 20 °C/min-100 °C/min.
6. Claim 1 A according to spark plasma sintering process and the hot-rolled alloy layered composite sheet material envelope method of preparing a TiAl/Ti, characterized in step two spark plasma sintering at a temperature of 1000 °C -1400 °C, a pressure of 30 mpa-100 mpa, temperature holding time of 2min-120min, after incubation with furnace cooled.
7. Claim 1 A according to spark plasma sintering process and the TiAl/Ti alloy layered composite sheet material envelope hot rolling method of preparation, characterized in step five will be obtained in step four post-weld sealing sheath placed in a heating furnace, and the heating furnace from room temperature to 1000 °C -1300 °C, again at a temperature of 1000 °C -1300 °C retained for 5min-100min, and then the capsule is placed on the side of the mill, and then the rolling rate of 0.05 m/s-2.5 m/s, stress concentrates to pass 5%-40%, the rolling total deformation of 30%-90% and a pass to the furnace temperature was 1000 °C -1300 °C retained for 5min-50min rolling is carried out at, to give the workpiece; and the workpiece is placed at a temperature of 1000 °C -1300 °C in a furnace, again closes the furnace power, the product is naturally cooled to 120 °C -600 °C, and the temperature of 120 °C -600 °C the product is taken out from the oven, allowed to cool to room temperature, and obtaining packet a sheathed steel.
8. Claim 1 A according to spark plasma sintering process and the TiAl/Ti alloy layered composite sheet material envelope hot rolling method of preparation, characterized in step five in the envelope of a post-weld sealing obtained in step four into a heating furnace, and the heating furnace from room temperature to 1000 °C -1350 °C, again at a temperature of 1000 °C -1350 °C

retained for 5min-80min, and then the capsule is placed on the side of the mill, and then the rolling rate of 0.1 m/s-2.5 m/s, stress concentrates to pass 5%-40%, the rolling total deformation of 30%-90% and a pass to the furnace temperature was 1000 °C -1350 °C retained for 5min-45min rolling is carried out at, to give the workpiece; and the workpiece is placed at a temperature of 1000 °C -1350 °C in a furnace, again closes the furnace power, the product is naturally cooled to 150 °C -600 °C, and the temperature of 150 °C -600 °C the product is taken out from the oven, allowed to cool to room temperature, and obtaining packet a sheathed steel.

9. Claim 1 A according to spark plasma sintering process and the hot-rolled alloy layered composite sheet material envelope method of preparing a TiAl/Ti, characterized in step five will be obtained in step four post-weld sealing sheath placed in a heating furnace, and the heating furnace from room temperature to 1270 °C, and then incubated at a temperature of 1270 °C 50min, and then the capsule is placed on the side of the mill, the rolling rate of 0.25 m/s again, stress concentrates to pass 10%, 76% and a total deformation of rolling pass to the furnace temperature is maintained at a temperature rolling is carried out under conditions of 1270 °C 15min, to give the workpiece; and the workpiece is placed in an oven at a temperature of 1270 °C, again closes the furnace power, the product is naturally cooled to 300 °C, and then the temperature was 300 °C the product is taken out from the oven, allowed to cool to room temperature, and obtaining packet a sheathed steel.

10. Claim 1 A according to spark plasma sintering process and the hot-rolled alloy layered composite sheet material envelope method of preparing a TiAl/Ti, characterized in step five in the envelope of a post-weld sealing obtained in step four into a heating furnace, and the heating furnace from room temperature to 1230 °C, and then incubated at a temperature of 1230 °C 70min, and then the capsule is placed on the side of the mill, the rolling rate of 0.2 m/s again, stress concentrates to pass 10%, 81% and the total deformation of rolling pass to the furnace temperature was 1230 °C rolling is carried out under conditions of incubation 10min, to give the workpiece; and the workpiece is placed in an oven at a temperature of 1230 °C, again closes the furnace power, the product is naturally cooled to 280 °C, and the temperature of 280 °C the product is taken out from the oven, allowed to cool to room temperature, and obtaining packet a sheathed steel.

Preparation method of high-performance TiAl alloy plate
CN105057384

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- **International Patent Classification**
  B21C-037/02 B22F-003/02 B22F-003/04
- **Publication Information**
  CN105057384 A 2015-11-18 [CN105057384]
- **Priority Details**
  2015CN-0465441 2015-07-31

- **Fampat family**

CN105057384	A	2015-11-18	[CN105057384]

- **Abstract:**
  (CN105057384)
  The invention relates to a preparation method of a high-performance TiAl alloy plate. The preparation method of the high-performance TiAl alloy plate aims at solving the problems that in the hot rolling process of existing TiAl alloy, due to the crystal grain growth, the nonuniform structure and stress concentration, a plate is cracked, the solid solution heat treatment process is tedious after rolling, the comprehensive performance of a TiAl alloy plate is lowered, and particularly plasticity is obviously lowered. The preparation method comprises the first step of preparation of TiAl alloy blank, the second step of sheathing, the third step of first-stage high-temperature rolling, the fourth step of second-stage high-temperature rolling, the fifth step of third-stage high-temperature rolling and the sixth step of mechanical machining and sheath removing. By means of the preparation method, crystal grains are thinned, the structure is made uniform, the plate is prevented from being cracked in the rolling process, the high-temperature deformation ability of the TiAl alloy plate is improved, and the large-size TiAl alloy plate with the excellent performance can be obtained.

Claims

(CN105057384)

1. TiAl alloy plate production method of a high-performance, characterized in a high-performance method for producing TiAl alloy plate is carried out in the following steps:

One, TiAl alloy billet production: the method of using powder metallurgy or secondary forging steel strip produced TiAl alloy preform, and the TiAl alloy preform to hot isostatic pressing treatment, and then using a hot isostatic pressing method of machining a preform processed TiAl alloy is processed into a rectangular blank, TiAl alloy billet was obtained;

Is a pre-alloyed powder method or element in step one powder metallurgy powder method;

Step one hot isostatic pressing treatment parameters: hot isostatic pressing at a temperature of 1000 °C -1250 °C, hot isostatic pressing at a pressure of 140 mpa-200 mpa, hot isostatic pressing time of 1h-5h;

Step one TiAl alloy billet has a thickness of 3 mm -30 mm;

Second, the sheath: a first step of the method of obtained by machining using TiAl alloy billet is subjected to surface grinding, to obtain a surface finish to Ra6-Ra8 alloy billet of a TiAl, and the surface finish of Ra6-Ra8 TiAl alloy billet envelope is carried out in a recess of a weld, TiAl alloy billet obtained of the capsule;

Third, high-temperature rolling 1st stage :-1 TiAl alloy billet of the capsule will be placed in an oven, the oven was raised from room temperature to a temperature of 1150 °C -1260 °C ;-2 at a temperature of 1150 °C -1260 °C incubated 5min-120min, then placed in a stand rolling ;-3 repeats step-2 operation 2-5 times, after stage 1st-rolling TiAl alloy billet to obtain a high temperature;

Step-2 in which the rolling parameters are: rolling temperature is 1150 °C -1260 °C, a strain rate of 0.001s-1-1s-1, pass deformation of 5%-25%, rolled total deformation of 30%-75%, pass to the furnace holding temperature of 1150 °C -1260 °C, pass to the furnace temperature holding time of 5min-60min;

Fourth, a high-temperature rolling 2nd stage :-1 1st-rolling step three obtained after stage TiAl alloy billet a high temperature of the furnace to be placed in 800 °C -1140 °C complete recrystalization heat treatment in an oven for a low temperature, the incubation time was 10min-120min, and then proceeds to the furnace temperature to 1150 °C -1260 °C furnace chamber for 5min-60min, was placed in a roll-stand rolling ;-2 repeats step-1 operation 1-3 times, after stage 2nd TiAl alloy billet to obtain a high-temperature rolling;

Step-1 in the rolling parameters are: rolling temperature is 1150 °C -1260 °C, a strain rate of 0.001-1s-1s-1, pass deformation of 5%-20%, pass to the furnace heat-retaining process is as follows: firstly at a temperature of 800 °C -1140 °C incubated 10min-120min, again at a temperature of 1150 °C -1260 °C incubated 5min-60min;

Five, 3rd stage where a high-temperature rolling :-1 obtained by the step four TiAl alloy billet after rolling 2nd stage placed in a high temperature furnace temperature was 1265 °C -1350 °C in the furnace insulation 5min-30min, and placed on top rolling mill ;-2 repeats step-1 operation 1-3 times, followed by cooling treatment, after stage 3rd TiAl alloy billet to obtain a high-temperature rolling;

Step-1 in the rolling parameters are: rolling temperature is 1265 °C -1350 °C, a strain rate of 0.001s-1-1s-1, pass deformation of 5%-20%, pass to the furnace retention temperature is 1265 °C -1350 °C, pass to the furnace soak times 5min-30min;

Step-2 cools down in the processing process is as follows: as the temperature of the furnace is placed into 850 °C -1000 °C were incubated in an oven 3h-6h, and then with the furnace cooled to room temperature;

Six, machining off envelope: obtained by mechanical processing method of rolling is removed after stage 3rd step five TiAl alloy billet a high temperature of the sheath, TiAl alloy sheet material was obtained.

2. A high-performance method for producing TiAl alloy plate according to claim 1, characterized in step one TiAl alloy billet component is: Ti - (42-45) Al - (6-9) V-(0.01% -0.6%) Y (at. %).

3. TiAl alloy plate production method of a high-performance according to claim 1, characterized in step one TiAl alloy billet component is: Ti - (43-45) Al - (6-9) Nb - (0.1-1) X (at. %), wherein X is an alloying element B, Si, C or Y or one of a mixture of several kinds.

4. A high-performance method for producing TiAl alloy plate according to claim 1, characterized in step one TiAl alloy billet component is: Ti - (43-48) Al - (2-6) Nb - (3-6) V-(0.1-1) X (at. %), wherein X is an alloying element B, Si, C or Y or a mixture of one of several kinds.

5. A high-performance method for producing TiAl alloy plate according to claim 1, characterized in step one TiAl alloy billet component is: ti-43Al-9V-0 (at. %).

6. A high-performance method for producing TiAl alloy plate according to claim 1, characterized in grooves in the second step by a stainless steel sheath, pure titanium or a titanium alloy machined groove envelope.

7. A high-performance method for producing TiAl alloy plate according to claim 1, characterized in step three -1 TiAl alloy billet will be obtained and a third step of the capsule placed in an oven, the oven was raised from room temperature to a temperature of 1150 °C -1200 °C; -2 in the third step at a temperature of 1150 °C -1200 °C 5min-60min incubated, and then placed on rolling on the rolling mill; -2 and a third step in the rolling parameters are: rolling temperature is 1150 °C -1200 °C, a strain rate of 0.01s-1-1s -1, 5% -25% amount of the flow pass, total deformation of 30% -75% of rolling, pass to a holding temperature of 1150 °C -1200 °C foundry, pass to the furnace temperature holding time of 5min-20min.

8. TiAl alloy plate production method of a high-performance according to claim 1, characterized in step four -1 1st step three obtained after stage TiAl alloy billet is rolled into a high temperature furnace temperature of 800 °C -1000 °C complete recrystalization heat treatment in an oven for a low temperature, the incubation time was 10min-120min, the furnace temperature is 1150 °C -1200 °C and then forwards it retained in a furnace 5min-60min, was placed in a roll-stand rolling; rolling parameter is in the fourth step -1: rolling temperature is 1150 °C -1200 °C, a strain rate of 0.01-1s-1s-1, 5% -20% amount of the flow pass, pass to the furnace heat-retaining process is as follows: first on a pass 800 °C -1000 °C holding temperature of foundry 10min-120min incubated, in yet pass 1150 °C -1200 °C holding temperature of foundry 5min-60min incubated.

9. A high-performance method for producing TiAl alloy plate according to claim 1, characterized in step five rolling 2nd stage -1 obtained after the step four TiAl alloy billet to a high temperature of the furnace temperature is 1265 °C -1300 °C placed in incubation 5min-30min in a furnace, and then put onto the rolling stand; -1 and a fifth step in the rolling parameters are: rolling

temperature is 1265 °C -1300 °C, a strain rate of 0.01s-1-1s-1, 5% -20% amount of the flow pass, pass to the furnace holding temperature is 1265 °C -1300 °C, pass to the furnace soak times 5min-30min.

10. TiAl alloy plate production method of a high-performance according to claim 1, characterized in step five -2 cools down in the processing process is as follows: the furnace temperature is 900 °C -1000 °C placed in incubation 5h in a furnace, and then with the furnace cooled to room temperature.

Ti2AlC particle refined gamma-TiAl intermetallic compound material and preparation method thereof

CN105039783

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- **International Patent Classification**
  C22C-001/03 C22C-014/00 C22C-032/00
- **Publication Information**
  CN105039783 A 2015-11-11 [CN105039783]
- **Priority Details**
  2015CN-0534619 2015-08-27

- **Fampat family**

CN105039783	A	2015-11-11	[CN105039783]

- **Abstract:**
  (CN105039783)
  The invention relates to an intermetallic compound material and a preparation method thereof, in particular to a Ti2AlC particle refined gamma-TiAl intermetallic compound material and a preparation method thereof, and aims to solve the technical problems that due to the fact that a violent exothermic reaction happens to monoplasmatic boron and TiAl alloy melt in the melting process, a large number of air holes exist in a cast ingot or casting, and the cost is high. The Ti2AlC particle refined gamma-TiAl intermetallic compound material is composed of Al, Nb, Cr, TiC and the balance Ti. The preparation method comprises the steps that 1, raw materials are weighed; 2, a pressing block is prepared; 3, the melt is prepared; and 4, the melt is cast into a preheated metal mould to form a Ti2AlC particle refined gamma-TiAl intermetallic compound cast ingot, and furnace cooling is carried out. The obtained gamma-TiAl intermetallic compound material is very small in microscopic structure, the size of a lamellar colony is about 100 micrometers, and formed Ti2AlC phases are evenly distributed in the structure. Due to the small and even structure free of obvious segregation, the comprehensive performance of alloy can be improved. The invention belongs to the field of preparation of the intermetallic compound material.

Claims

(CN105039783)

1. Ti2AlC of grain refining -TiAl intermetallic compound material, characterized in Ti2AlC of grain refining -TiAl intermetallic compound material in accordance with the percentage by number 46%-48% of a Al, 2% of a Nb, Cr 2% to, and the balance Ti composition 0.5-1% of TiC.
2. According to claim 1 Ti2AlC of grain refining -tial intermetallic compound material, characterized in Ti2AlC of grain refining -tial intermetallic compound material in accordance with a percentage content of Al by 47% by atoms per, 2% of a Nb, Cr 2% to, TiC and the balance Ti 0.6% of a composition.
3. According to claim 1 Ti2AlC of grain refining -tial intermetallic compound material, characterized in Ti2AlC of grain refining -tial intermetallic compound material in accordance with 46% Al atoms per percentage by which, of a 2% Nb, 2% of a Cr, TiC and the balance Ti 0.7% of a composition.
4. According to claim 1 Ti2AlC of grain refining -tial intermetallic compound material, characterized in Ti2AlC of grain refining -tial intermetallic compound Al in accordance with a percentage content of 48% by number of atoms of a material, 2% of a Nb, Cr 2% to, 0.8% TiC and the balance Ti composition for.
5. Claim 1 Ti2AlC of grain refining -tial a method for manufacturing an intermetallic compound, characterized in Ti2AlC of grain refining -tial intermetallic compound a manufacturing method includes following steps:
One, in accordance with atoms were weighed percentage content of 46%-48% to Al, 2% of a Nb, Cr of a 2%, the proportion of Ti and the balance of titanium sponge 0.5-1% of TiC, high purity aluminum, aluminum and niobium master alloy, electrolytic chromium and TiC powder;
Second, the step a scale for compact acquire raw materials by metal briquette press molding, to obtain compacts, the compacts when each layer is a titanium sponge layer from bottom to top, a high-purity aluminum layer, aluminum and niobium master alloy layer, electrolytic chromium layer, TiC layer and a titanium sponge layer;
Three, the resulting compacts into a crucible induction melting furnace in a water-cooled copper to, smelting ofthenniernulsion metal mold preheated to 300-400 °C, water-cooled copper crucible vacuum induction melting furnace was evacuated to 1.0-3.0 x10-3mbar, to 10-15 kw/min rate the molten power was raised to 85-90 kw is stopped after increasing the power, and then the compact melting at a constant power 300-360s, resulting melt;
Four, the melt is cast into a preheated metal mold, to form Ti2AlC of grain refining -TiAl intermetallic compound ingot, and then furnace cooled.
6. According to claim 5 Ti2AlC of grain refining -tial a method for manufacturing an intermetallic compound, characterized in step one was weighed in accordance with a percentage content of Al atoms per 47% of a, 2% of a Nb, Cr 2% to, TiC and the balance Ti 0.6% to.
7. According to claim 5 Ti2AlC of grain refining -tial a method for manufacturing an intermetallic compound, characterized in step three was melted in a metal mold preheated to 350 °C ofthenniernulsion.
8. According to claim 5 Ti2AlC of grain refining -tial a method for manufacturing an intermetallic compound, characterized in step three will be water-cooled copper crucible vacuum induction melting furnace chamber was evacuated to 2.0x10-3mbar.
9. According to claim 5 Ti2AlC-tial intermetallic compound particle refining method of preparation thereof, characterized in step three to 12 kw/min rate was raised to 88 kw power stops increasing after the molten power.
10. According to claim 5 Ti2AlC of grain refining process for producing -tial intermetallic compound material, characterized in step three in the smelting compact 350s at a constant power.

Uniform TiAl alloy lamellar structure and preparation method thereof
CN104928531

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- **International Patent Classification**
  C22C-001/03 C22C-014/00 C22C-030/00
- **Publication Information**
  CN104928531 A 2015-09-23 [CN104928531]
- **Priority Details**
  2015CN-0239382 2015-05-12
- **Fampat family**
  CN104928531 A 2015-09-23 [CN104928531]

- **Abstract:**
  (CN104928531)
  The invention discloses an uniform TiAl alloy lamellar structure and a preparation method thereof, relates to a TiAl alloy and a preparation method thereof, and aims to solve the problems of weak plasticity of a traditional TiAl alloy and bad TiAl alloy performance caused by such single elements as boron and carbon refining a cast-state TiAl alloy structure. The uniform TiAl alloy lamellar structure comprises the following components in percentage by weight: 43-48% of Al, 0-2% of Cr, 0-2% of Nb, 0.5-1% of B, 0.1-1% of C and the balance of Ti; the compressive strength of the unform TiAl alloy lamellar structure is 1687-2370 MPa; and the compression ratio is 23-32%. The preparation method comprises (1) material weighing and (2) mixing; and the uniform TiAl alloy lamellar structure is prepared. The method can obtain the uniform TiAl alloy lamellar structure.

Claims

(CN104928531)

1. A homogenized tissue TiAl alloy sheet, characterized in a tissue by weight percentage 43% uniform TiAl alloy sheet-48% Al, 0% -2% Cr, 0%-2% Nb, 0.5%-1% B, 0.1%-1% C and the balance consisting Ti; TiAl uniform compressive strength of tissue sheet alloy 1687 mpa-2370 mpa, the compression rate is 23%-32%.

2. Homogenizing a tissue ply TiAl alloy preparation method according to claim 1, characterized in a sheet of tissue is prepared by homogenizing TiAl alloy of method steps:

A, weighing: Al elements in weight percent: 43%-48%, Cr: 0%-2%, Nb: 0%-2%, B: 0.5%-1%, C: 0.1% -Ti 1% and the balance, are weighed ingot, the intermediate aluminum and niobium alloys, chromium powder, sponge titanium grade 0, a boron-containing material and carbonaceous material as a raw material;

Second, mixing:

When weighing elements in percentage by weight in the step one Cr 0%, in particular when Nb element weight percentage of 0% are as follows:

A step of the ingot to a size of less than 10 cm is weighed3 aluminum block; titanium sponge in a weighing stage and the step 0 copper crucible melting furnace is added to; size less than 10 cm and the3 of aluminum on the titanium sponge in 0 stages; a boron raw material weighed and the raw material and a carbon in a step added to the smelting furnaces within the hopper secondary, the melting furnace is evacuated to a vacuum of 10-3mbar, then 10 kw/min in speed-load power to 20 kw/min 200 kw -300 kw, melting copper to completely melted mixed material within the crucible, the alloy melt obtained; within the hopper and then has secondary raw material added to the alloy melt carbonaceous raw material and boron in the, heat to which the alloy melts, and the alloy is melted and kept at 15min-20min, to obtain an alloy melt TiAl; flipped and then copper crucible, the melt is poured into a 400 °C temperature again TiAl alloy-steel mold 600 °C, after the melting furnace is filled with argon to 1min, and then the furnace, then naturally cooled to room temperature, is homogenized tissue TiAl alloy layer;

When weighing elements weight percent Cr in step a is 0%, the specific weight percent is no element Nb 0% is carried out in the following steps of:

Weighing the ingot in one step to a size of less than 10 cm3 aluminum block; titanium sponge in a weighing stage and the step 0 is evenly divided into two parts, one of which 0 parts of titanium sponge copper crucible melting furnace is added to stage; further intermediate step of a weighed-piles in tile aluminum and niobium in the crucible 0 the copper alloy titanium sponge stage above; re-piles copper crucible to a further portion of the titanium sponge stage 0, and the 10 cm size3 of aluminum on the titanium sponge in 0 stage; a boron-containing raw material and weighing step again carbonaceous material within the hopper into the melting furnace adding secondary, the smelting furnace is evacuated to a vacuum of 10-3mbar, to 10 kw/min and then on speed-load power to 20 kw/min 200 kw -300 kw, melting copper to completely melted material within the crucible mixture, to obtain an alloy melt; within the hopper and then has secondary raw material added to the alloy melt in the boron-containing material and carbon, to heat the alloy melts, and the alloy is melted and kept at 15min-20min, to obtain an alloy melt TiAl; copper crucible and then inverted, and the temperature of the melt poured into 400 °C TiAl alloy-steel mold 600 °C, after smelting furnace is filled with argon to 1min, and then the furnace, then naturally cooled to room temperature, is homogenized tissue TiAl alloy layer;

When in a weighing step is not less 0% Cr element, is in particular 0% by weight elemental Nb steps of:

Weighing the aluminum ingot to a size of a step is less than 10 cm3 aluminum block; and the weighed average grade titanium sponge in a step 0 of the divided into two portions, one of which stages the titanium sponge copper smelter added to 0 parts of the crucible; the plated chromium powder was weighed in step a-piles of titanium sponge copper crucible above the level of 0; addition thereto of the smelting copper crucible 0 parts titanium sponge stage a, less than 10 cm and the size3 of aluminum on the titanium sponge in 0 stages; and the weighed raw materials and carbonaceous materials in the step one boron-containing secondary hopper into the melting furnace in addition, the smelting furnace evacuated to a vacuum of 10-3mbar, and then on speed is 10 kw/min-load power to 20 kw/min 200 kw -300 kw, melting copper to completely melted mixed material within the crucible, to obtain an alloy melt; and then has secondary hopper boron-containing material and carbonaceous material within the melt added to the alloy, melting the alloy to heat, and the alloy is melted and kept at 15min-20min, to obtain an alloy melt TiAl; flipped and then copper crucible, the melt is poured into a 400 °C temperature again TiAl alloy-steel mold 600 °C, after the melting furnace is filled with argon to 1min, and then the furnace, then naturally cooled to room temperature, is homogenized tissue TiAl alloy layer;

When weighing element in the step one Cr 0% by weight is not, when specifically Nb 0% in elemental weight percentage of the steps of:

A weighing step to a size of less than 10 cm of the ingot3 aluminum block; titanium sponge in a step and the weighing stage 0 in two average, 0 grade titanium sponge is added to an aliquot of the copper crucible vessel; a weighing and the step of evenly mixing the master alloy and the aluminum and niobium chromium powder, chromium powder and the master alloy and the uniformly mixed aluminum and niobium crucible 0 grade titanium sponge copper-piles in tile above ;-piles copper crucible again a further portion of the titanium sponge grade 0, less than 10 cm and the size3 of aluminum on the titanium sponge in 0 stages; and the weighed raw materials and carbonaceous materials in the step one boron-containing secondary hopper into the melting furnace in addition, the smelting furnace evacuated to a vacuum of 10-3mbar, and then on speed is 10 kw/min-load power to 20 kw/min 200 kw -300 kw, melting copper to completely melted mixed material within the crucible, to obtain an alloy melt; and then has secondary hopper boron-containing material and carbonaceous material within the melt added to the alloy, melting the alloy to heat, in which the alloy melts and is maintained at a temperature 15min-20min, to obtain an alloy melt TiAl; and then copper crucible inverted, and the alloy melt is poured into a 400 °C temperature TiAl-mold 600 °C of the steel, after melting within the furnace flushed with argon to 1min, then the furnace, then naturally cooled to room temperature, is homogenized tissue plies TiAl alloy.

3. Homogenizing tissue plies TiAl alloy prepared by a method according to claim 2, characterized in the raw material powder containing boron is in the second step, TiB_2 powder or B_4C powder.

4. Homogenizing a tissue ply TiAl alloy preparation method according to claim 2, characterized in the carbonaceous material is carbon powder in step two, powder or TiC B_4C powder.

5. Producing a homogenized tissue plies TiAl alloy method according to claim 2, characterized in purity of the titanium sponge in the step one 0 stage 99.9 wt.%, purity ingot 99.99 wt.%, chromium powder purity 99.9 wt.%, aluminum and niobium in the master alloy Nb mass fraction of 50% - 60%.
6. A uniform layer of tissue TiAl alloy production method according to claim 2, characterized in a step intermediate particle size less than 5 mm in aluminum and niobium alloys, chromium powder with a particle size less than 5 mm, less than 10 mm particle size of the titanium sponge grade 0.
7. A uniform layer of tissue TiAl alloy production method according to claim 3, characterized in the particle size of less than 50 m boron, TiB2 powder particle size less than 50 m, B4C powder particle size less than 50 m.
8. Producing a homogenized tissue plies TiAl alloy method according to claim 4, characterized in the particle size of less than 50 m carbon, less than 50 m powder including TiC, B4C powder particle size less than 50 m.
9. Homogenizing tissue plies TiAl alloy prepared by a method according to claim 2, characterized in by weight for each element in the step one Al: 48%, B: 0.8%, C: 0.2% and the balance Ti, are weighed ingot, 0 grade titanium sponge, a boron-containing material and carbonaceous material as a raw material.
10. Homogenizing tissue plies TiAl alloy prepared by a method according to claim 2, characterized in by weight for each element in the step one Al: 48%, Cr: 2%, Nb: 2%, B: 0.8%, C: 0.2% and the balance Ti, are weighed ingot, aluminum and niobium master alloy, chromium powder, boron-containing material and carbonaceous material to titanium sponge and class 0 material.

Preparation method of TiAl alloy investment casting shell
CN104907495

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- **International Patent Classification**
  B22C-001/00 B22C-009/04
- **Publication Information**
  CN104907495 A 2015-09-16 [CN104907495]
- **Priority Details**
  2015CN-0412506 2015-07-14
- **Fampat family**
  CN104907495 A 2015-09-16 [CN104907495]

- **Abstract:**
  (CN104907495)
  The invention provides a preparation method of a TiAl alloy investment casting shell. The preparation method of the TiAl alloy investment casting shell aims at solving the problems of high cost and heavy interface reaction of the existing TiAl alloy investment casting ceramic shell. The method comprises the steps of 1, preparing the slurry of a surface layer, 2, preparing a surface-layer shell, 3, preparing an impending surface-layer shell, 4, preparing a back-layer shell, 5, sealing, and 6, dewaxing and roasting. The preparation method is used for remarkably reducing the degree of the TiAl alloy investment casting interface reaction and achieving the purposes of reducing the TiAl alloy investment casting cost and reducing the interface reaction. The shell casting is bright in surface without obvious sand burning; the thickness of the interface reaction is about 30 microns and the interface reaction degree is weaker than that of the traditional shell.

Claims
(CN104907495)
1. TiAl alloy investment foundry one process for the preparation of said shell, characterized in the method is carried out in the following steps:
One, face stock formulation: at a stirring speed of 20 r/min-40 r/min under the conditions of foaming agent and wetting agent was added to the ammonium zirconium carbonate, to obtain a mixture, and then at an addition rate was 200 g/min-300 g/min to the resulting mixture were added ZrO_2 and a $CaCO_3$, at a stirring speed of 20 r/min-40 r/min under conditions of stirring and mixing to ZrO_2 and a $CaCO_3$ uniformly dispersed in the mixture, and then at a stirring speed of 80 r/min-100 r/min with stirring under a 22h-24h, further left for 8h-12h, give the face stock;
ZrO_2 with $CaCO_3$ mass ratio of (1.0-1.5): 1; ZrO_2 with $CaCO_3$ with the sum of masses of a mass ratio of ammonium zirconium carbonate (2.5-3.0): 1; ammonium zirconium carbonate with a defoaming agent mass ratio of 100: (0.05-0.2); ammonium zirconium carbonate with a wetting agent mass ratio of 100: (0.05-0.2);
Second, sheet-type shell was prepared: one face stock obtained in the step of immersing a wax, a wax model surface is fully coated face stock rotation of the wax model, and then coated with a layer slurry lifting of wax, and subjected to multi-axis rotation, while rotating in rainfall sanding machine using pour evenly distributing slurry layer is coated with a layer of particle size of 80 surface of wax purpose ZrO_2 sand, then continues at constant temperature and humidity was allowed to dry 22h-24h, giving top-type housing;
Constant temperature and humidity parameters are: temperature of 25 °C, a humidity of 50%-60%;
Third, temporary preparation of mold-facing layer: the step will be derived layer-type shell is immersed in a first step of the resulting layer slurry, places the surface type shell completely by pivotally moving the cover type top ply slurry was coated, and then coated with a surface layer in a mold-up coat slurry, followed by a multi-axis rotation, while rotating in rainfall sanding machine is used which is coated with a layer of face stock surface type pour evenly distributing a particle size of the shell surface of an object 80 ZrO_2 sand, then continues at constant temperature and humidity was allowed to dry 22h-24h, surface type to give temporary shell;
Constant temperature and humidity parameters are: temperature of 25 °C, a humidity of 50%-60%;
Four, back-layered shell was prepared: at a stirring speed of 20 r/min-40 r/min under the conditions of the silica sol was added at a rate to to 200 g/min-300 g/min added diatomaceous earth, and then at a stirring speed of 40 r/min-60 r/min agitating and mixing under conditions of 6h, resulting slurry having a back layer, and then steps back layer slurry just obtained by three shell is immersed in surface type, surface type shell surface type shell comes to rotate just completely by the backing layer slurry was coated, after which the coated pro surface layer molds with a back layer of slurry lifting, followed by a multi-axis rotation, while rotating the coated with rainfall sanding machine pro surface type pour evenly distributing shell surface with a back layer a layer of sand slurry, dried under conditions of constant temperature and humidity is then passed to 22h-24h, give the back layer type shell;
Silica sols with diatomaceous earth mass ratio of 1: (1.6-2.2);
Constant temperature and humidity parameters are: temperature of 25 °C, a humidity of 50%-60%;
Sand having a particle size or a size of 32 to 32 object mullite abrasive grits purpose quartz sand;
Five, slurry seal: the step four resulting obtained back layer type shells of the back layer sanding operation 3 times, and then the dried back-layered shell is immersed in the slurry in the backing layer in step four, the back-layered shell is rotated back-layered shell completely by the backing layer slurry was coated, was then lifted back-layered shell coated with a backing layer of a slurry, dried under conditions of constant temperature and humidity at 45h-50h, slurry seal coat obtained after;
The method comprises the sanding back layer: the step four the resulting back-layered shells of the multi-axis rotation, while rotating in the rainfall sanding machine pour evenly distributing surface of shell back layer type with a layer of sand, then continues at constant temperature and humidity was allowed to dry 22h-24h;
Constant temperature and humidity parameters are: temperature of 25 °C, a humidity of 50%-60%;
Sand having a particle size or a size of 32 to 32 object mullite abrasive grits purpose quartz sand;
Six, dewaxing and burning: a shell after the step five resulting slurry seal steam dewaxing, dewaxing pressure of 0.5 mpa-0.7 mpa, dewaxing time of 6min-10min, high-temperature oven was placed in a muffle furnace will de-waxing completed molds made was heated to a temperature of 400 °C, and is incubated at a temperature of 400 °C 2h, further increasing the temperature to a temperature of 800 °C, and is incubated at a temperature of 800 °C 2h, and then elevated to a temperature of 1100-1450 °C, and at a temperature of 1100-1450 °C retained for 2h, complete firing, TiAl alloy investment foundry shell was obtained.
2. TiAl alloy investment one method for producing foundry shell, characterized in step one ZrO_2 a particle size of 320 mesh.
3. TiAl alloy investment shell was prepared foundry one method, characterized in step one $CaCO_3$ a particle size of 320 mesh.
4. TiAl alloy investment shell was prepared foundry one method, characterized in step one ZrO_2 with $CaCO_3$ mass ratio of 1.2: 1.
5. TiAl alloy investment foundry one process for the preparation of said shell, characterized in step one ZrO_2 with $CaCO_3$ with ammonium zirconium carbonate mass ratio of the sum of the mass of 2.8: 1.
6. TiAl alloy investment one method for producing foundry shell, characterized in step one defoamer is a silicone anti-foaming agents.
7. TiAl alloy investment shell was prepared foundry one method, characterized in step one the wetting agent was JFC.
8. TiAl alloy investment shell was prepared foundry one method, characterized in step one ammonium zirconium carbonate mass ratio of 100:0 .1 with a defoaming agent.
9. TiAl alloy investment shell was prepared foundry one method, characterized in step one ammonium zirconium carbonate mass ratio of 100:0 .125 with a wetting agent.
10. TiAl alloy investment one method for producing foundry shell, characterized in step four silica sol with a diatomaceous earth mass ratio of 1:2 .0.

Preparation method of tau 3 phase containing gamma-TiAl IMC (intermetallic compound)

CN104789806

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- **International Patent Classification**
  C22C-001/02 C22C-014/00
- **Publication Information**
  CN104789806 A 2015-07-22 [CN104789806]
- **Priority Details**
  2015CN-0154813 2015-04-02
- **Fampat family**
  CN104789806 A 2015-07-22 [CN104789806]

- **Abstract:**
  (CN104789806)
  The invention discloses a preparation method of a tau 3 phase containing gamma-TiAl IMC (intermetallic compound), relates to a preparation method of the IMC, and provides a preparation method of a novel gamma-TiAl based alloy which does not contain beta phase and has good hot-working property in order to solve the technical problem that the creep property of a material is weakened due to introduction of the beta phase. The method comprises steps as follows: raw materials are weighed; pressing blocks are prepared; the pressing blocks are put in a water-cooling copper crucible induction melting furnace for smelting to obtain melt; the melt is cast in a metal casting mold and is naturally cooled in the furnace, and the IMC is obtained. According to the preparation method, the Ni element is added, the tau 3 phase is introduced and has the characteristic of high-temperature softening, and the thermal deformation capacity of the traditional gamma-TiAl based alloy is improved; the optimal addition quantity range of Ni is determined, due to addition of Ni in a material solidification process, a solidification way of the alloy is changed from a traditional way of L to (L+beta) to alpha...to a way of L to (L+beta) to (alpha+tau3)..., the microscopic structure of the prepared gamma-TiAl IMC material is small and uniform and is free of obvious segregation, and follow-up thermal-mechanical treatment is facilitated. The invention belongs to the field of preparation of the IMC.

Claims

(CN104789806)

1. Containing 3 phase -TiAl production method of the intermetallic compound, characterized in containing 3 phase -TiAl intermetallic compounds prepared in accordance with the following procedure:
A, is weighed raw material: the elemental mole Al 45-2 48% Ni element mole-ratio of weighed Ti 3% and the balance of titanium sponge, high purity aluminum and nickel beans;
Second, a step of weighing raw material of titanium sponge layer from bottom to top in, high purity aluminum layer, nickel titanium sponge layer sequence by a briquetting machine briquette bean layer and the metal mold, resulting compact;
Three, the compact is put into water-cooled copper crucible induction melting furnace, melting the metal mold preheated to 300 pre-400 °C, the water-cooled copper crucible vacuum induction melting furnace is evacuated to 1.0-3.0 x10-3mbar, to 10-melting power rate up to 85 15 kw/min-90 kw, and then power of 85-smelting of 360 90 kw -480s, so as to melt;
Four, obtained in the third step of casting a melt into preheated metal in the mold, and then furnace cooled, to give a 3 phase -TiAl intermetallic compound.
2. According to claim 1-3 intermetallic compound is -TiAl production method, characterized in 99.7% purity titanium sponge mass in one step.
3. According to claim 1-3 phase -TiAl preparation method of the intermetallic compound, characterized in first step high-purity aluminum having a purity of 99.99% by mass.
4. According to claim 1-3 intermetallic compound is -TiAl production method, characterized in purity nickel beans in step a mass of 99.99%.
5. According to claim 1, 2, 3 or 4 containing 3 phase -TiAl preparation method of the intermetallic compound, characterized in that in step three prior to melting the metal mold preheated to 350 °C.
6. According to claim 1, 2, 3 or 4 containing 3 intermetallic compound is -TiAl production method, characterized in that in step three the water-cooled copper crucible vacuum induction melting furnace is evacuated to 2.0x10-3mbar.
7. According to claim 1, 2, 3 or 4 containing 3 intermetallic compound phase method for preparing -TiAl, characterized in that in step three rate melting power up to 88 kw 10-15 kw/min.
8. According to claim 1, 2, 3 or 4 containing 3 phase -TiAl production method of the intermetallic compound, characterized in that in step three with a power of 87 kw 400s of melting.

Method for preparing TiAl alloy component by near-isothermal die forging
CN104588997

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- **International Patent Classification**
  B21J-005/00 B21J-005/02 B23P-015/00 C22C-014/00
- **Publication Information**
  CN104588997 A 2015-05-06 [CN104588997]
- **Priority Details**
  2015CN-0028183 2015-01-20

- **Fampat family**

CN104588997	A	2015-05-06	[CN104588997]

- **Abstract:**
  (CN104588997)
  The invention provides a method for preparing a TiAl alloy component by near-isothermal die forging, relates to a preparation method of the alloy component, and aims at solving the problems of a TiAl alloy component prepared by an existing method that TiAl alloy is difficult to prepare, the machining is difficult, the requirements on dies and equipment are high and the mechanical property is poorer. The preparation method comprises the following steps: preparing a TiAl alloy casting ingot, carrying out homogenized heat treatment, carrying out hot isostatic pressing, covering and forging, turning and machining and carrying out the near-isothermal die forging to prepare the TiAl alloy component. According to the method, the TiAl alloy casting ingot is subjected to the homogenized treatment, the hot isostatic pressing and the covering and forging in sequence and is then subjected to the near-isothermal die forging finally to prepare the TiAl alloy component. The TiAl alloy component prepared by the method has small tissues, good mechanical property and low requirements on equipment and forging dies. The method for preparing the TiAl alloy component by the near-isothermal die forging can be obtained.

Claims
(CN104588997)
1. A method of producing near-isothermal TiAl swaging alloy member, characterized in preparing a concrete TiAl member near isothermal method is a swaging step is completed following alloy of:
One, prepared alloy ingot TiAl: ingredient is selected nominal Ti-(40-50) Al-(0.1-10) X (at %) of the alloy ingot TiAl;
In the step one Ti-(40-50) Al-(0.1-10) X (at %) is Mo X in, Cr, Nb, V, Si, Fe, Zr, Mn, B, C, wherein one or several Y W and a mixture of;
Two, a homogenization heat treatment: the selected ingot to a homogenization heat treatment step, heat treatment temperature of 800 °C of the uniform-1000 °C, a homogenizing heat treatment temperature holding time of 12h-100h, alloy ingot obtained after homogenization treatment TiAl;
Three, hot isostatic pressing: the alloy ingot is homogenized for processing TiAl hot isostatic pressing treatment, to obtain blank TiAl blockers;
In the step three hot isostatic pressing treatment at a temperature of 1100 °C -1280 °C, a pressure of 100 mpa-200 mpa, time of 1h-4h;
Four, forging envelope: placing the envelope blank in the blockers TiAl, followed by a heat sealing, envelope blank acrude TiAl blockers; TiAl envelope blank comprises forging the blockers and the processing, comprising an envelope blank TiAl blockers and the oil was cooled to room temperature, further comprising removing the mechanical processing of the blank envelope TiAl blockers method in the envelope, obtained by forging TiAl alloy billet;
Step four sheath is made of stainless steel, titanium or titanium alloy;
Four forging step of processing temperature is in the 1100 °C -1280 °C, retaining time is 2h-12h, is a forging reduction ratio 50%-90%;
Five, turning: the step of machining the resulting four TiAl method machined blank in a forging alloy, to obtain pre-swaging TiAl blank;
Six, swaging near isothermal: the preheating temperature is 860 °C-put into a preheated blank TiAl 1300 °C to 850 °C the temperature of the pre-swaged-mold of 1200 °C, a strain rate of at 0.005s-1-1s-1 at near isothermal die, to give TiAl alloy member;
Step six is a titanium alloy forging die with a high temperature mold.
2. A method of swaging members near isothermal TiAl alloy prepared according to claim 1, characterized in that a step is selected nominal formula of the alloy ingot TiAl Ti-(41-44) Al-(4-9) X (at %).
3. A method of preparing TiAl swaging near isothermal alloy member according to claim 1, characterized in that a step is selected in the nominal formula TiAl alloy ingot Ti-(45-48) Al-(4-8.5) X (at %).
4. A method of preparing TiAl near isothermal swaging alloy member according to claim 1, characterized in that a step is selected in the nominal formula TiAl alloy ingot Ti -43Al-9V-0.3Y (at %).
5. A method of producing near-isothermal TiAl swaging alloy member according to claim 1, characterized in the step of homogenizing heat treatment temperature in 900 °C of di -950 °C, homogenizing heat treatment of the holding time of 12h-48 h.
6. A method of swaging members near isothermal TiAl alloy prepared according to claim 1, characterized in that processing step four forging temperature of 1150 °C -1280 °C, retaining time is 5h-10h, 50% are forged depression-70%.
7. A method of preparing TiAl swaging near isothermal alloy member according to claim 1, characterized in that processing step four forging temperature of 1100 °C -1250 °C, retaining time is 4h-8h, is a forging reduction ratio 50%-60%.
8. A preparation method of swaging members near isothermal TiAl alloy according to claim 1, characterized in step six is preheated to a temperature of 900 °C-blank TiAl 1100 °C of the pre-swaging, put into a preheated temperature to 850 °C post-mold of 1000 °C, a strain rate of at 0.005s-1-0.1s-1 at near isothermal die, to give TiAl alloy member.
9. A method of preparing TiAl near isothermal swaging alloy member according to claim 1, characterized in step six is preheated to a temperature of 850 °C-blank of pre-swaging TiAl 1050 °C, after 850 °C is put into a preheated temperature-mold of 900 °C, a strain rate of at 0.05s-1-0.5s-1 at near isothermal die, to give TiAl alloy member.

Method of preparing TiAl alloy plate by virtue of spark plasma sintering and canning hot rolling

CN104588433

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  B21C-037/02 B22F-003/105

- **Publication Information**
  CN104588433 A 2015-05-06 [CN104588433]
- **Priority Details**
  2015CN-0028165 2015-01-20

- **Fampat family**
  CN104588433 A 2015-05-06 [CN104588433]

- **Abstract:**
  (CN104588433)
  The invention discloses a method of preparing a TiAl alloy plate by virtue of spark plasma sintering and canning hot rolling, relates to a preparation method of an alloy plate and aims at solving the problems of uneven chemical components, inconsistency in tissues, poor performance of the plate and difficulty in preparation of the traditional preparation method of the TiAl alloy plate. The method comprises the following steps: carrying out spark plasma sintering on TiAl pre-alloyed powder firstly to prepare a pre-rolled plate slab, and then preparing the TiAl alloy plate by virtue of a canning hot rolling method. According to the method disclosed by the invention, the TiAl alloy plate slab prepared by spark plasma sintering is high in density, fine in tissue, uniform in components, excellent in performances, good in deformability, convenient in subsequent formation of the TiAl alloy plate, fine in grain size of the prepared plate and excellent in mechanical properties, is capable of carrying out high-temperature canning rolling on TiAl alloy at a relatively low temperature and high strain rate and is suitable for preparing the TiAl alloy plate.

Claims

(CN104588433)

1. A spark plasma sintering method of making hot rolled alloy sheet TiAl and the envelope, characterized in a spark plasma sintering method and the package sleeve by making TiAl alloy hot rolling step is completed in the sheet material:

A, the raw material preparation: weighing 0.5 m particle diameter of-the chemical composition of 325 m nominal Ti-(40-50) Al-(0.1-10) X (at %) of the pre-alloyed powder TiAl;

In the step one Ti-(40-50) Al-(0.1-10) X (at %) is Mo X in, Cr, Nb, V, Si, Fe, Zr, Mn, B, C, one or several Y W and a mixture of;

A step of chemical components in the nominal Ti-(40-50) Al-(0.1-10) X (at %) of an inert gas or atomized prealloyed TiAl by rotation of the atomizing electrode plasma technology technique;

Two, spark plasma sintering:

The step of pre-weighed TiAl alloy powder into a graphite mold, at a pressure of 10 mpa-200 mpa, at a temperature of 900 °C-to 1300 °C 10 and vacuum-4Pa-10Pa sintering the 1min-60min, resulting in a density of 95% -blank 100%;

Three, turning:

Denseness of the second step by a 95% -turning and the rounded blank of 100%, having a surface finish resulting Ra6-Ra8 of the slab;

Four, the blank envelope:

As a surface finish of the three steps Ra6-Ra8 into the envelope in a slab, followed by the sealing, the sealing of the package sheath which is obtained after the slab;

Step four ladle sets envelope is made of stainless, pure titanium or titanium sheath envelope;

Step four surface of the sheath thickness is 1 mm -20 mm;

Five, hot rolling the envelope:

The frame of the capsule is placed in a heating after the sealing of the package with the slab, and the heating furnace from room temperature to 1000 °C -1280 °C, 1000 °C at a temperature of re-incubated at 0.5h 1280 °C -4h, and the temperature was to 1000 °C-sealed capsule is placed in a post-braze 1280 °C slab mill on a package, the rolling rate of 0.01 m/s-1.5 m/s, is a 5% deformation passes-30%, 30% total deformation roll-pass back to the furnace temperature is 90% and the 1000 °C-at 1280 °C, insulation 2min-60 min rolling conditions, the stock obtained; 1000 °C pieces placed in a temperature of the re-heating furnace 1280 °C, again closes the furnace power supply, is cooled to 100 °C natural rolled-900 °C, 100 °C and the temperature was as-rolled 900 °C removed from the oven, cooled to room temperature, with a surface of the sheath obtained rolled sheet;

Sixth, removing the capsule is:

Obtained in step five removal machining method using the envelope sheet with envelope in the rolling, to obtain TiAl alloy sheet.

2. A spark plasma sintering method of making hot rolled alloy sheet TiAl and the envelope according to claim 1, characterized in a particle size of 0.5 m step weighing-chemical composition of 325 m of the nominal Ti-(42-45) Al-(0.3-10) X (at %) TiAl a pre-alloyed powder.

3. A hot spark plasma sintering method and the envelope TiAl alloy sheet material prepared according to claim 1, characterized in a particle diameter of 0.5 m in the step of weighing-chemical composition is 325 m of the nominal Ti-(45-48) Al-(0.2-6.5) X (at %) of the pre-alloyed powder TiAl.

4. A spark plasma sintering method and the envelope sheet prepared TiAl hot rolled alloy according to claim 1, characterized in a particle diameter of 0.5 m in the step of weighing-chemical composition of 325 m nominal Ti -43Al-9V-0.3Y (at %) TiAl a pre-alloyed powder.

5. A spark plasma sintering method of preparing a hot-rolled TiAl alloy sheet and an envelope according to claim 1, characterized in that in step two the weighed TiAl into a pre-alloyed powder of step in a graphite mold, at a pressure of 40 mpa-100 mpa, at a temperature of 900 °C -10 of 1200 °C and vacuum-4Pa-10Pa sintering the 1min-20min, an obtained density of 95% -blank 100%.

6. A discharge plasma sintering method and the preparation of a hot-rolled sheet TiAl alloy envelope according to claim 1, characterized in step two the step of pre-weighed powder into a graphite die TiAl alloy, at a pressure of 30 mpa-90 mpa, a temperature of from 950 °C -10 of 1250 °C and vacuum-3Pa-10-1Pa sintering the 2min-15min, an obtained density of 95% -blank 100%.

7. A hot spark plasma sintering method and the envelope TiAl alloy sheet material prepared according to claim 1, characterized in the the sealing step comprises five frame of the capsule is placed in a heating a slab of the post, the re-heating furnace from room temperature to 1100 °C -1250 °C, 1100 °C at a temperature of the re-incubated at 1h 1250 °C -2h, is 1100 °C and the temperature was-coated capsule is placed in a 1250 °C sealed on the slab mill after welding.

8. A spark plasma sintering method of making hot rolled alloy sheet TiAl and the envelope according to claim 1, characterized in that in step five rolling rate of 0.01 m/s-0.5 m/s, is a 8% deformation passes-20%, 60% of the total deformation roll-pass to the furnace temperature is 90% and the 1100 °C-incubated at 4min 1250 °C -10min of the rolling conditions, the stock obtained.

9. A spark plasma sintering method and the envelope sheet prepared TiAl hot rolled alloy according to claim 1, characterized in the sealing step the frame of the five coated capsule is placed in a heating after the slab, the re-heating furnace from room temperature to 1120 °C -1240 °C, 1120 °C at a temperature of re-incubated at 1h 1240 °C -1.5h, and the temperature was to 1120 °C-sealed envelope placed on 1240 °C of the rolling mill on the slab after welding a package.

10. A spark plasma sintering method of preparing a hot-rolled TiAl alloy sheet and an envelope according to claim 1, characterized in that in step five rolling rate of the 0.01 m/s-1.0 m/s, is 8% deformation passes-20%, 60% of the total deformation roll-pass back to the furnace temperature is 90% and the 1120 °C-incubated at 5min 1240 °C -15min of the rolling conditions, the stock obtained.

Preparation method of TiAl alloy profile
CN104588653

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• **Fampat family**

CN104588653	A	2015-05-06	[CN104588653]

• **Abstract:**
(CN104588653)
The invention discloses a preparation method of a TiAl alloy profile, and relates to a preparation method of an alloy profile. The preparation method aims to solve the problems of large TiAl alloy structure, composition segregation, higher impurity content and defect density, easy cracking and high requirement on equipment and molds existing in a TiAl alloy profile prepared by an existing method. The preparation method comprises the following steps: 1, raw material preparation; 2, densification treatment; 3, lathe machining; 4, blank sheath preparation and pre-extrusion; 5, high-temperature hot extrusion, thus obtaining the TiAl alloy profile. Firstly densification treatment is carried out on TiAl prealloy powder, and then high-temperature hot extrusion is carried out to prepare the TiAl alloy profile; the TiAl alloy profile prepared by the preparation method is small in grain size, high in density, uniform in compositions and excellent in performance. The preparation method of the TiAl alloy profile can be obtained.

Claims

(CN104588653)

1. A method for producing alloy section TiAl, characterized in a method according to the following profile TiAl alloy of the step is finished is specific:

A, the raw material preparation: weighing particle diameter of 0.5 m-to 325 m of the nominal formula Ti-(40-50) Al-(0.1-10) X (at %) of TiAl pre-alloyed powder;

In the step one Ti-(40-50) Al-(0.1-10) X (at %) is in X Mo, Cr, Nb, V, Si, Fe, Zr, Mn, B, C, W Y and the one or several elements therein;

A step in the nominal formula of Ti-(40-50) Al-(0.1-10) X (at %) of the pre-alloyed powder is TiAl by inert gas atomization technique or plasma technique of the rotating electrode atomization;

Second, the densification treatment: step a weighed particle size of from 0.5 m-to 325 m of the nominal formula Ti-(40-50) Al-(0.1-10) X (at %) of a pre-alloyed powder processing TiAl, TiAl blank obtained;

A particle size of the weighed step in step two is 0.5 m -325 m nominal formula Ti-(40-50) Al-(0.1-10) X (at %) of the heat treated powder is a prealloyed TiAl, spark plasma sintering and hot isostatic pressing processing the one or more;

Three, turning: mechanical processing TiAl obtained in step two the machined blank, to obtain a pre-extrusion billet TiAl;

Fourth, pre-extrusion was prepared blank sheath: turning a pre-extrusion in step four into a blank TiAl in the envelope, followed by the sealing, to obtain a blank sheath pre-squeeze;

Step four envelope is made of stainless steel, titanium or titanium alloy;

Step four sheath has a thickness of 2 mm -20 mm;

Five, high-temperature hot extrusion: the frame of the pre-pressed blank sheath placed in a heating, from room temperature to 1000 °C and the furnace-1350 °C, 1000 °C at a temperature of re-incubated at 1350 °C 0.5h-4h, and the temperature is 1000 °C-pre-extrusion was put into a preheated blank sheath temperature of 1350 °C 600 °C-temperature alloy extruding die 1 1000 °C of the primary-secondary 10, obtained by extrusion, and the extrusion temperature is placed in a 1000 °C -1350 °C in a heating furnace, the furnace power off again, the squeezing member to cool down to 100 °C -900 °C, 100 °C and the temperature-extrusion removed from the oven 900 °C, cooled to room temperature, , TiAl profile is obtained;

Step five extruding the extrusion speed is 0.01 m/s-1.5 m/s, total extrusion ratio (2-16): 1.

2. A method for producing profile TiAl alloy according to claim 1, characterized in step a particle size of 0.5 m is weighed-nominal 325 m formula Ti-(41-44) Al-(4-9) X (at %) of TiAl pre-alloyed powder.

3. A profile alloy preparation TiAl method according to claim 1, characterized in step a particle size of 0.5 m is weighed-325 m nominal formula Ti-(45-48) Al-(4-8.5) X (at %) of TiAl pre-alloyed powder.

4. A method for producing profile TiAl alloy according to claim 1, characterized in a step size of 0.5 m is weighed-325 m nominal formula Ti -43Al-9V-0.3Y (at %) of TiAl pre-alloyed powder.

5. A method for producing profile TiAl alloy according to claim 1, characterized in that in step two hot-pressing sintering pressure of 20 mpa-150 mpa, temperature 850 °C -1350 °C, the sintering time is 0.5h-4h; step two spark plasma sintering pressure of 40 mpa-100 mpa, the sintering temperature was 900 °C -1300 °C, degree of vacuum was 10-4Pa-10Pa, the sintering time was 2min-60min; step two hot isostatic pressing temperature is 1100 °C -1280 °C, a pressure of 140 mpa-200 mpa, time 1h is -4h.

6. A method for producing profile TiAl alloy according to claim 1, characterized in that in step two hot-pressing sintering pressure of 40 mpa-80 mpa, temperature 1000 °C -1300 °C, the sintering time is 1h-4h; step two spark plasma sintering pressure of 50 mpa -80 mpa, the sintering temperature is 950 °C -1200 °C, evacuated to 10-4-10Pa, sintering time is 5min-20min; step of hot isostatic pressing at 1100 °C two-1250 °C, a pressure of 160 mpa-200 mpa, time is 1.5h-2.5h.

7. A method for producing profile TiAl alloy according to claim 1, characterized in step five frame of the pre-pressing the blank sheath placed in a heating, from room temperature to 1180 °C and the furnace-1280 °C, 1180 °C at a temperature of re-incubated at 1280 °C 0.5h-4h, and the temperature is 1180 °C-put into a preheated temperature to 1280 °C of a pre-extrusion blank sheath 700 °C-temperature alloy mold extruding 2 900 °C primary-secondary 5, obtained by extrusion.

8. A profile alloy preparation TiAl method according to claim 1, characterized in that in step five extruding the extrusion speed is 0.01 m/s-0.5 m/s, total extrusion ratio (2-10): 1.

9. A method for producing profile TiAl alloy according to claim 1, characterized in the frame of the pre-crushing step five blank sheath placed in a heating, from room temperature to 1150 °C and the furnace-1300 °C, 1150 °C at a temperature of re-incubated 1h 1300 °C -4h, and the temperature is 1150 °C-pre-extrusion was put into a preheated blank sheath of 1300 °C to 750 °C temperature-high-temperature alloy extruding die 2 950 °C primary-secondary 6, obtained by extrusion; extruding the extrusion speed in step five is 0.15 m/s-0.3 m/s, total extrusion ratio (2-12): 1.

Method for producing members through near-isothermal stamping by aid of TiAl pre-alloy powder

CN104551571

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- **International Patent Classification**
  B21J-005/02 B22F-003/04 B22F-003/10 B23P-015/00
- **CPC Code**
  B21J-005/02; B22F-003/04; B22F-003/10/17 B23P-015/00;
- **Publication Information**
  CN104551571 A 2015-04-29 [CN104551571]
- **Priority Details**
  2015CN-0028111 2015-01-20
- **Fampat family**

CN104551571	A	2015-04-29	[CN104551571]

- **Abstract:**
  (CN104551571)
  A method for producing members through near-isothermal stamping by aid of TiAl pre-alloy powder relates to a production method of alloy members. The purpose is to solve the problems of the TiAl alloy members produced through the existing method of coarse TiAl alloy structures, composition segregation, high impurity content, low density, member crack aptness and high requirements for dies and equipment. The production method includes: 1, raw material preparation; 2, densifying; 3, turning; 4, near-isothermal stamping to obtain TiAl alloy structures. According to the method, TiAl pre-alloy powder is subjected to densifying and near-isothermal stamping to produce the TiAl alloy structures, thus the TiAl alloy structures can be produced simply through normal forging machines and high temperature alloy dies for titanium alloy forging. The TiAl alloy structures produced in the method are small in grain size, high in density, even in composition and excellent in performance. The method can be used for producing the members through near-isothermal stamping by aid of TiAl pre-alloy powder.

Claims

(CN104551571)

1. A pre-alloyed powder TiAl method of producing near-isothermal swaging member, characterized in a pre-alloyed powder TiAl member in particular to a method of producing near-isothermal swaging steps performed:

A, the raw material preparation: weighed particle size of 0.5 m-to 325 m of the nominal formula Ti-(40-50) Al-(0.1-10) X (at %) of the pre-alloyed powder TiAl;

In the step one Ti-(40-50) Al-(0.1-10) X (at %) is Mo X in, Cr, Nb, V, Fe, Mn, B, C, W wherein one or several Y and the mixture;

A step in a nominal formula Ti-(40-50) Al-(0.1-10) X (at %) by inert gas atomization TiAl is a pre-alloyed powder or plasma technique atomizing technique of the rotating electrode;

Two, densification treatment: the step of a weighed particle size of 0.5 m-to 325 m of the nominal formula Ti-(40-50) Al-(0.1-10) X (at %) of the pre-alloyed powder processed TiAl, the resulting preform TiAl;

The step in step two is weighed 0.5 m of a diameter-to 325 m of the nominal formula Ti-(40-50) Al-(0.1-10) X (at %) of the pre-sintered powder is heat treated alloy TiAl, spark plasma sintering and hot isostatic pressing treatment is one or several of;

Three, turning: the method of machining the preform obtained in step two TiAl machined, to give blockers TiAl member blank;

Four, near isothermal forging: pre-heating temperature is 860 °C-of the blockers TiAl member blank is put into a preheated temperature 1300 °C 850 °C-mold of 1200 °C, a strain rate of at 0.001s-1-1s-1 at near isothermal forging, TiAl alloy structural member obtained;

In the fourth step is a titanium alloy forging die with a high temperature mold.

2. Preparing a pre-alloyed powder near isothermal TiAl method of swaging member according to claim 1, characterized in a particle diameter of 0.5 m in the step of weighing-to 325 m of nominal formula Ti-(41-44) Al-(4-9) X (at %) TiAl a pre-alloyed powder.

3. Preparing one of the swaging member pre-alloyed powder near isothermal TiAl method according to claim 1, characterized in a particle diameter of 0.5 m are weighed in the step-of 325 m of nominal formula Ti-(45-48) Al-(4-8.5) X (at %) of a pre-alloyed powder TiAl.

4. A pre-alloyed powder TiAl method of producing near-isothermal swaging member according to claim 1, characterized in a weighing step particle size of 0.5 m-to 325 m of the nominal formula Ti -43Al-9V-0.3Y (at %) of the pre-alloyed powder TiAl.

5. Preparing a pre-alloyed powder near isothermal TiAl method of swaging member according to claim 1, characterized in that in step two pressure of 20 mpa-100 mpa, a temperature of 850 °C -1350 °C, the sintering time is 2h-8 h; spark plasma sintering in step two is a pressure of 40 mpa-100 mpa, the sintering temperature is 850 °C -1250 °C, 10 is a vacuum-4-10Pa, sintering time is 1min-30min; temperature of the hot isostatic pressing in step two is 1100 °C -1280 °C, a pressure of 140 mpa-200 mpa, the time 1h is -4h.

6. Preparing a pre-alloyed powder near isothermal TiAl method of swaging member according to claim 1, characterized in that in step two hot press sintering pressure of 40 mpa-150 mpa, a temperature of 1000 °C -1300 °C, the sintering time is 1h-4h; spark plasma sintering in step two is a pressure of 50 mpa-80 mpa, the sintering temperature is 800 °C -1280 °C, a degree of vacuum 10 is-4-10Pa, the sintering time is 2min-60min; second step of hot isostatic pressing temperature is in the 1100 °C -1250 °C, a pressure of 160 mpa-200 mpa, period is 1.5h-2.5h.

7. A swaging member near isothermal TiAl pre-alloyed powder preparation method according to claim 1, characterized in the step of pre-heating temperature in 900 °C tetra-blockers TiAl member is put into a preheated temperature 1100 °C 850 °C of the blank-mold of 950 °C, at a strain rate is 0.001s-1-0.1s-1 at near isothermal forging, TiAl alloy structural member obtained.

8. A swaging member near isothermal TiAl pre-alloyed powder preparation method according to claim 1, characterized in the step of pre-heating temperature in 950 °C tetra-blockers TiAl member is put into a preheated temperature 1150 °C 850 °C of the blank-mold of 1000 °C, a strain rate of at 0.05s-1-0.5s-1 at near isothermal forging, to give TiAl alloy member.

Method for improving properties of TiAl alloy by adding graphene
CN104561629

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- **International Patent Classification**
  C22C-001/05 C22C-014/00
- **Publication Information**
  CN104561629 A 2015-04-29 [CN104561629]
- **Priority Details**
  2015CN-0028122 2015-01-20

- **Fampat family**

CN104561629	A	2015-04-29	[CN104561629]

- **Abstract:**
  (CN104561629)
  The invention provides a method for improving the properties of a TiAl alloy by adding graphene and relates to a method for improving the properties of the TiAl alloy. The method is used for solving the problems of poor abrasive resistance, insufficient oxidization resistance above 700 DEG C, poor mechanical properties and the like of the existing TiAl alloy. The method comprises the steps of mixing the graphene with TiAl prealloy powder by use of a mechanical dispersing method to prepare TiAl mixed powder in which the graphene is distributed evenly, and then densifying the mixed powder to obtain the TiAl alloy. The graphene is evenly dispersed in the TiAl mixed powder prepared by use of the method without agglomeration, and the TiAl prealloy powder is covered with the fine flake graphene to form an excellent contact interface; the partial graphene is kept in the original state in the densified TiAl alloy, and evenly distributed. The obtained TiAl alloy is improved in abrasive resistance, oxidization resistance and mechanical properties. The invention relates to the method for improving the properties of the TiAl alloy by adding graphene.

Claims

(CN104561629)

1. Adding graphene improved properties of TiAl alloy, characterized in adding the specific properties of improved graphene TiAl alloy is accomplished following steps:

A, a pre-alloyed powder preparing TiAl: 0.5 m particle diameter is weighed-325 m nominal formula Ti-(40-50) Al-(0.1-10) X (at %) of TiAl pre-alloyed powder;

In the step one Ti-(40-50) Al-(0.1-10) X (at %) is in X Mo, Cr, Nb, V, Si, Fe, Zr, Mn, B, W Y and the one or a mixture of them;

Name of the chemical in the step one Ti-(40-50) Al-(0.1-10) X (at %) of a pre-alloyed powder is TiAl by inert gas atomization techniques or plasma technique of the rotating electrode atomization;

Second, graphene TiAl mixed powder preparation comprising:

A particle diameter of 0.5 m was weighed in step-a 325 m nominal formula Ti-(40-50) Al-(0.1-10) X (at %) of the pre-alloy powder and the graphene powder is added to the mixing machine TiAl mixer, in an inert gas and at mixing machine speed is 10 r/min-300 r/min under conditions of a mixing machine, each mixing machine 0.5h-2.5h, the mixing machine 5min-20min, until the total mixing machine time is 2h-50h, the mixing machine, the mixed powder to obtain graphene uniformly distributed TiAl;

Step two graphene powder TiAl pre-alloyed powder at a mass ratio (0.0001-0.05): 1;

Three, densification treatment: the second step the graphene TiAl mixed powder of the densification treatment is uniformly distributed, resulting TiAl alloy;

In the step three heat treatment is sintering densification, spark plasma sintering and hot isostatic press treatment of the one or more.

2. Adding graphene TiAl improved properties of the alloy method according to claim 1, characterized in a step of size 0.5 m is weighed-325 m nominal formula Ti-(41-44) Al-(4-9) X (at %) of TiAl pre-alloyed powder.

3. Adding graphene TiAl improved properties of the alloy method according to claim 1, characterized in a weighed 0.5 m particle size in step-a 325 m nominal formula Ti-(45-48) Al-(4-8.5) X (at %) of TiAl pre-alloyed powder.

4. Adding graphene improved properties of TiAl alloy according to claim 1, characterized in a weighed 0.5 m particle size in step-a 325 m nominal formula Ti -43Al-9V-0.3Y (at %) of TiAl pre-alloyed powder.

5. Adding graphene TiAl improved properties of the alloy method according to claim 1, characterized in that in step three hot-pressing sintering processes are: pressure of 20 mpa-150 mpa, temperature 850 °C -1350 °C, the sintering time is 0.5h-8h; step three in the spark plasma sintering processes are: pressure of 40 mpa-100 mpa, the sintering temperature is 1000 °C -1300 °C, evacuated to 10-4Pa-10Pa, sintering time is 2min-60min; in the third step of hot isostatic pressing processes: temperature 1000 °C -1250 °C, a pressure of 140 mpa-200 mpa, time is 0.5h-4h.

6. Adding graphene improved properties of TiAl alloy according to claim 1, characterized in that in step three hot-pressing sintering processes are: pressure of 40 mpa-80 mpa, temperature 1000 °C -1300 °C, the sintering time was 1h-4h; step three in the spark plasma sintering processes are: pressure of 50 mpa-80 mpa, the sintering temperature was 900 °C -1250 °C, degree of vacuum was 10-4-10Pa, the sintering time was 5min-30min; in the step three is hot isostatic pressing procedure: temperature is 1100 °C -1300 °C, a pressure of 160 mpa-200 mpa, time is 1.5h-6h.

7. Adding graphene improved properties of TiAl alloy, characterized in adding the specific properties of improved graphene TiAl alloy is accomplished following steps:

A, raw material preparation: 0.5 m particle diameter is weighed-325 m nominal formula Ti-(40-50) Al-(0.1-10) X (at %) of TiAl pre-alloyed powder;

In the step one Ti-(40-50) Al-(0.1-10) X (at %) is in X Mo, Cr, Nb, V, Si, Fe, Zr, Mn, B, W Y and the one or a mixture of them;

Name of the chemical in the step one Ti-(40-50) Al-(0.1-10) X (at %) of a pre-alloyed powder is TiAl by inert gas atomization techniques or plasma technique of the rotating electrode atomization;

Second, dispersed graphene: the graphene is added to the dispersant, the ultrasonic power of 100W-1500W under ultrasonic dispersion 0.1h-4h, to obtain graphene dispersed liquid; graphene and the dispersion liquid at a temperature of 40 °C -0.1h at 100 °C -4h, to obtain a dried dispersion of graphene powder;

Step two dispersant is anhydrous ethanol or acetone;

Step two graphene is a graphene layer;

Step two graphene volume ratio of the mass of the dispersant (0.001g-10g): 1000 ml;

Third, mixed powder containing the graphene prepared TiAl: a step in a particle diameter of 0.5 m is weighed-325 m nominal formula Ti-(40-50) Al-(0.1-10) X (at %) of a pre-alloyed powder and dried TiAl powder is added to mixing machine with a graphene dispersion, under in an inert gas, mixing machine speed is 10 r/min-300 r/min under conditions of a mixing machine, each mixing machine 0.5 h -2.5h, the mixing machine 5min-20min, until the total mixing machine time is 2h-50h, the mixing machine, the mixed powder to obtain graphene TiAl uniformly distributed;

Step three dried dispersed graphene powder with a mass ratio of pre-alloyed powder TiAl (0.0001-0.05): 1;

Four, densification processing: step three graphene TiAl mixed powder obtained in the densification treatment is uniformly distributed, resulting TiAl alloy;

Heat treatment is sintering densification in step four, spark plasma sintering and hot isostatic press one or more treated.

8. Adding graphene improved properties of TiAl alloy according to claim 7, characterized in a weighed 0.5 m particle size in step-a 325 m nominal formula Ti-(41-44) Al-(4-9) X (at %) of TiAl pre-alloyed powder.

9. Adding graphene TiAl improved properties of the alloy method according to claim 7, characterized in a step of size 0.5 m is weighed-325 m nominal formula Ti -43Al-9V-0.3Y (at %) of TiAl pre-alloyed powder.

10. Adding graphene TiAl improved properties of the alloy method according to claim 7, characterized in hot press sintering in the fourth step of processes: pressure of 40 mpa-80 mpa, temperature 1000 °C -1300 °C, the sintering time is 1h-4h; spark plasma sintering in the fourth step of processes: pressure of 50 mpa-100 mpa, the sintering temperature is 900 °C -1250 °C, evacuated to 10-4-10Pa, sintering time is 5min-30min; in the fourth step is hot isostatic pressing processes: temperature 1100 °C -1300 °C, the pressure is 140 mpa-200 mpa, time is 1.5h-6h.

Tau3-phase-containing gamma-TiAl intermetallic compound cast ingot and preparation method thereof

CN104404345

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- **International Patent Classification**
  C22C-001/03 C22C-030/00
- **Publication Information**
  CN104404345 A 2015-03-11 [CN104404345]
- **Priority Details**
  2014CN-0631907 2014-11-11

- **Fampat family**

CN104404345	A	2015-03-11	[CN104404345]

- **Abstract:**
  (CN104404345)
  The invention relates to a gamma-TiAl intermetallic compound cast ingot and a preparation method thereof, and specifically relates to a tau3-phase-containing gamma-TiAl intermetallic compound cast ingot and a preparation method thereof. The invention provides a tau3-phase-containing gamma-TiAl intermetallic compound cast ingot and a preparation method thereof. The provided tau3-phase-containing gamma-TiAl intermetallic compound cast ingot is composed of sponge titanium, high-purity aluminum, aluminum-niobium intermediate alloy, electrolytic chromium, and bean-shaped nickel. The preparation method comprises the following steps: step one, weighing sponge titanium, high-purity aluminum, aluminium-niobium intermediate chromium, and bean-liked nickel; step two, pressing the raw materials into metal blocks; step three, smelting and casting so as to obtain the tau3-phase-containing gamma-TiAl intermetallic compound cast ingot. The microscopic structure of the obtained gamma-TiAl intermetallic compound material is very fine, the size of the lamellar colony is around 100 [mu]m, and the formed tau3 phase mainly appears on the crystal boundary of the lamellar colony and is distributed in a net shape. The provided cast ingot is mainly used in the field of preparation of lightweight heatproof high temperature structural materials.

Claims

(CN104404345)

1. Comprising a 3 phase -TiAl ingot intermetallic compound, characterized in containing 3 phase -TiAl intermetallic compound elements in a molar percentage of ingot Al: 47%-48%, Nb: 2%, Cr: 2%, Ni: 2% -Ti 3% and the balance, by a sponge titanium, high purity aluminum, aluminum and niobium master alloy, made of electrolytic chromium and nickel beans.

2. Comprising a 3 phase -TiAl ingot method for the preparation of an intermetallic compound, characterized in containing 3 phase -TiAl intermetallic compounds are prepared by ingot carried out as follows:

A, in molar percent Al elements: 47%-48%, Nb: 2%, Cr: 2%, Ni: 2%-3% and the balance Ti, are weighed titanium sponge, high-purity aluminum, aluminum and niobium master alloy, electrolytic chromium and nickel beans;

Second, a step of forming the metal briquette briquette weighed metal, titanium sponge layer are layers compact is from bottom to top, high-purity aluminum, aluminum and niobium intermediate alloy layer, electrolysis pure chromium layer, a nickel titanium sponge layer and the bean layer, to obtain metal compact;

Three, the water-cooled copper crucible induction melting furnace to preheat 300-400 °C metal mold, and then the second step the water-cooled copper crucible induction melting furnace into a compact metal, a vacuum 1.0x10-3-3.0x10-3mbar, the power rate rises to 10-15 kW/min melt obtained after smelting 300-400 s 80-90 kW molten, the melt is then cast into the preheated metal in the mold, and then furnace cooled, that obtain a 3 phase -TiAl intermetallic ingot;

Wherein, the titanium sponge mass purity of 99.7%, 99.99% purity by high-purity aluminum, aluminum and niobium intermediate alloy mass having a purity of 99.8%, the quality of purity electrolytic chromium is 99.99%, the quality of purity 99.99% nickel beans; each material is commercially available.

3. Comprising a 3 phase -TiAl ingot producing an intermetallic compound according to claim 2, characterized in that in step three metal mold preheated to 350-400 °C.

4. Comprising a 3 phase -TiAl ingot production method of the intermetallic compound according to claim 2, characterized in that in step three is evacuated to 1.8x10-3-2.0x10-3mbar.

5. Comprising a 3 phase -TiAl ingot producing an intermetallic compound according to claim 2, characterized in the melting power in step three 85-90 kW rate up to 10 kw/min.

6. Comprising a 3 phase -TiAl ingot production method of an intermetallic compound according to claim 2, characterized in that in step three melting 300-360 s.

7. Comprising a 3 phase -TiAl ingot production method of the intermetallic compound according to claim 2, characterized in that in step three metal mold size 50x 60 mm.

Fully lamellar heat treatment method of tau 3 phase-containing gamma-TiAl intermetallic compound cast ingot

CN104388862

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- **International Patent Classification**
  C22F-001/18

- **Publication Information**
  CN104388862 A 2015-03-04 [CN104388862]
- **Priority Details**
  2014CN-0631906 2014-11-11

- **Fampat family**

CN104388862	A	2015-03-04	[CN104388862]

- **Abstract:**
  (CN104388862)
  The invention provides a fully lamellar heat treatment method of a tau 3 phase-containing gamma-TiAl intermetallic compound cast ingot and aims at obtaining a fine and uniform fully lamellar texture by carrying out heat treatment on a tau 3 phase-containing gamma-TiAl based alloy and further optimizing the texture and improving the properties of the alloy. The method comprises the following steps: putting an alloy test sample into a crucible and then putting the crucible into a heat treatment furnace for heat preservation, next, transferring to the heat treatment furnace with a temperature of 900 to 1000 DEG C and preserving heat for 30-50 minutes, and then cooling along with the furnace until the temperature reaches a room temperature, thus obtaining the alloy test sample subjected to heat treatment; performing annealing treatment on the alloy test sample subjected to heat treatment to obtain a uniform fully lamellar structure of which the average grain size of the lamellar crystal cluster is within the range of 100 to 200 microns. The fully lamellar heat treatment method is applied to the heat treatment of the tau 3 phase-containing gamma-TiAl intermetallic compound cast ingot.

Claims

(CN104388862)

1. Comprising a 3 phase -TiAl intermetallic ingot fully lamellar heat treatment method, characterized in containing 3 phase -TiAl intermetallic compound in the ingot heat treatment step of the method is fully lamellar is:

Containing 50x 60 mm size from 3 phase -TiAl ingot core cut size of intermetallic compounds (10x10x10) mm-(20x20x20) mm of the alloy samples, after the alloy sample is loaded into the crucible into a heat treatment furnace, at a temperature of 1350 °C-incubating under conditions 1h 1400 °C -4h, and then transferred to the furnace is 900 °C -1000 °C of the heat treatment furnace, at a temperature of 900 °C-incubating under conditions 30min 1000 °C -50min then, the oil was cooled to room temperature, after heat treatment of the alloy samples obtained; annealed sample of the heat-treated alloy, uniform average grain size in a colony sheet obtained by sheet tissue 100-200 µm whole, is complete-3 phase -TiAl intermetallic ingot fully lamellar heat treatment ;-3 phase -TiAl the ingot intermetallic compound elements is mole percent Al: 47%-48%, Nb: 2%, Cr: 2%, Ni: 2% -Ti 3% and the balance, by a sponge titanium, high-purity aluminum, aluminum and niobium master alloy, made of electrolytic chrome and nickel beans.

2. Comprising a 3 phase -TiAl intermetallic ingot fully lamellar heat treatment method according to claim 1, characterized in containing 3 phase -TiAl ingot is prepared by steps of the intermetallic compound is:

A, in mole percent Al elements: 47%-48%, Nb: 2%, Cr: 2%, Ni: 2%-3% and the balance Ti, are weighed titanium sponge, pure aluminum, aluminum and niobium master alloy, electrolytic chromium and nickel beans;

Second, a step of forming metal by metal briquette briquette weighed, compact layers are titanium sponge layer is from bottom to top, pure aluminum, aluminum and niobium intermediate alloy layer, electrolysis pure chromium layer, a nickel titanium sponge layer and the bean layer, to obtain metal compact;

Three, the water-cooled copper crucible induction melting furnace in a metal mold preheated to 300-400 °C, then metal compact obtained in step two water-cooled copper crucible induction melting furnace, a vacuum 1.0x10-3-3.0x10-3mbar, the melting power 80-90 kW melting 10-15 kW/min to a rate up to the melt obtained after 300-400 s, and then casting a melt into the preheated metal in the mold, and then furnace cooled, that obtain a 3 phase -TiAl intermetallic ingot;

Wherein, 99.7% purity titanium sponge mass, high-purity aluminum having a purity of 99.99% by mass, 99.8% purity aluminum and niobium intermediate alloy mass, electrolytic chromium 99.99% purity quality, purity 99.99% nickel beans mass; the raw material is a commercial product.

3. Comprising a 3 phase -TiAl intermetallic ingot fully lamellar heat treatment method according to claim 1, characterized in 1360 °C at a temperature of incubating under conditions 4h.

4. Comprising a 3 phase -TiAl intermetallic ingot fully lamellar heat treatment method according to claim 1, characterized in the incubation conditions at a temperature of 1400 °C 2h.

5. Comprising a 3 phase -TiAl intermetallic ingot fully lamellar heat treatment method according to claim 1, characterized in the furnace and transferred to a heat treatment furnace is of 950 °C.

Method for casting and forming TiAl-based alloy vent valve
CN104190900

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- **International Patent Classification**
  B22D-018/06

- **Publication Information**
  CN104190900 A 2014-12-10 [CN104190900]
- **Priority Details**
  2014CN-0443044 2014-09-02

- **Fampat family**

CN104190900	A	2014-12-10	[CN104190900]

- **Abstract:**
(CN104190900)
The invention provides a method for casting and forming a TiAl-based alloy vent valve, and relates to casting methods for the TiAl-based alloy vent valve. The technical problems that gravity casting of an existing TiAl-based alloy vent valve can not enable mold filling to be conducted smoothly, inner quality can not be guaranteed, a centrifugal casting method is complex in process, the material utilization rate is low, the casting process is too complex, and the surface quality is poor are solved. The method mainly comprises the steps that first, the prior art is used for manufacturing a metal mold of the vent valve; second, the metal valve of the vent valve in the first step is placed in a suction casting chamber of a smelting furnace, and the metal mold of the vent valve is mounted on a mold seat; third, a graphite suction port is mounted on a water cooling crucible; fourth, a TiAl-based alloy pig which is smelted in advance is placed in a suction casting crucible of a vacuum arc melting furnace, and overheating melt is obtained by smelting; fifth, a vacuum system of a suction casting chamber of the vacuum arc melting furnace is opened, a suction casting button is opened, suction casting, mold filling and cooling are conducted, and a casting is obtained. The method is used for preparing TiAl-based alloy vent valve castings.

Claims

(CN104190900)

1. A cast molding method of the exhaust valve TiAl-based alloy, characterized in: forming a casting of the exhaust valve based alloy TiAl in the following method steps:

A step, producing exhaust valve metal mold(7), intermediate mold(7) cavity formed with the exhaust valve metal (7-1), exhaust valve inside a mold(7) is formed with two exhaust passages (7-3), two exhaust passages (7-3) disposed along the cavity (7-1) on both sides of, the exhaust passage (7-3) upper end of the cavity (7-1) communicate, the exhaust passage (7-3) against the lower end of the bottom of the mold(7), the mold(7) upper surface of annular grooves (7-4), the exhaust valve gate of the metal mold(7) (7-2) the annular seal groove (7-4) in;

Step two, the die mounted on(10) the seal(9) 1st, the seal ring is installed(6) in the annular grooves 2nd (7-4) within, the smelter suction casting chamber(8) mounted in the die(10), a manufacturing step of the melting furnace exhaust valve within the suction casting chamber(8) in a mold(7), and mounted in the die(10);

Changing, graphite-cooled copper crucible(3) mounted on the mouthpiece(5), the mouthpiece(5) with the exhaust valve gate graphite mold(7) (7-2) aligned;

Step four, the pre-melting of the alloy ingot into a vacuum arc melting furnace TiAl-suction casting crucible (3-1) in, and the melting chamber evacuated to(2) 0.02Pa-0.5Pa, then the shielding gas to a pressure of 40kPa-60kPa, the re-melting the ingot, the melting current is 100A-500A, 2min smelting-4min then, increasing the arc current to 400A-650A, and maintaining the 1min-2min, to obtain super-heated melt;

Step five, vacuum arc remelting furnace opening of the suction casting chamber(8) vacuum system, suction casting button opening, while melting the current increase 600-850 A, the frame of the hot melt pressure and the vacuum pressure under the combined effects of gravitational force, by rapidly suction exhaust valve metal mold cavity(7) is filled with graphite (7-1), the exhaust valve to the mold(7) cavity (7-1) of the casting is cooled to room temperature, the vacuum release suction casting chamber, the exhaust valve open mold(7), obtained by casting.

2. An exhaust valve TiAl-based alloy cast molding method according to claim 1, characterized in: the step of melting the four alloy ingot into a non-consumable TiAl group of vacuum arc remelting furnace suction casting crucible (3-1) in, and the melting chamber evacuated to(2) 0.1Pa-0.4Pa.

3. An exhaust valve-based alloy as cast TiAl method according to claim 1 or 2, characterized in: the shielding gas in the fourth step to a pressure of 42kPa-58kPa.

4. An exhaust valve TiAl-based alloy cast molding method according to claim 3, characterized in: the pre-melting of step four-alloy ingot into a vacuum arc melting furnace TiAl suction casting crucible (3-1) within, firstly melting chamber evacuated to(2) below 5Pa, then the melting chamber(2) is filled with argon, vacuum pumping argon system opening, each aerating and pumping twice, the last evacuated to 0.02Pa-0.1Pa, followed by melting.

5. A method of forming cast base alloy TiAl exhaust valve according to claim 1 or 2, characterized in: in step four the melting current is 300A, 2min after smelting, increasing the arc current to 400A-600A, and maintaining the 1min-2min, the resulting hot melt.

6. An exhaust valve-based alloy as cast TiAl method according to claim 1 or 2, characterized in: in the fourth step is 150-480 A melting current, after smelting 2.5-2.8 min, increasing the arc current to 450A-600A, and maintaining the 1min-2min, to obtain super-heated.

7. Forming a casting of the exhaust valve based alloy TiAl method according to claim 1 or 2, characterized in: melting current is in the fourth step 300A, after smelting 3min, increased arc current to 525A, and hold 1.5min, obtained by hot melt.

8. A method of forming cast base alloy TiAl exhaust valve according to claim 1 or 2, characterized in: the smelting step five current increased to 700A.

Preparation method of Ti5Si3 particle-reinforced TiAl-matrix composite material board

CN103436832

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- **International Patent Classification**
  B22F-007/04 C22F-001/00 C22F-001/04 C22F-001/18
- **Publication Information**
  CN103436832 A 2013-12-11 [CN103436832]
- **Priority Details**
  2013CN-0403381 2013-09-06

- **Fampat family**

CN103436832	A	2013-12-11	[CN103436832]

- **Abstract:**
  (CN103436832)
  The invention discloses a preparation method of a Ti5Si3 particle-reinforced TiAl-matrix composite material board, relating to a preparation method of a TiAl-matrix composite material board. The preparation method is used for solving the problem of low breaking strength and elongation of the Ti5Si3 particle-reinforced TiAl-matrix composite material board prepared by the existing method. The preparation method comprises the following steps: alternately overlapping an Al-Si alloy foil and a pure Ti foil, and then performing hot pressing to prepare a multi-layer Ti-(Al-Si) composite board; and performing thermal treatment on the multi-layer Ti-(Al-Si) composite board to prepare the Ti5Si3 particle-reinforced TiAl-matrix composite material board. According to the preparation method disclosed by the invention, the preparation process is pollution-free, the production technology is simple and easy to implement, the efficiency is high, and the cost is low; and the interface bonding between in-situ synthesis small dispersed Ti5Si3 particles and the TiAl matrix is excellent, and the material has high density and high strength. The preparation method disclosed by the invention is used for preparing a Ti5Si3 particle-reinforced TiAl-matrix composite material board.

Claims

(CN103436832)

1. One Ti5Si3 TiAl-based composite material production method of particle-reinforced sheet material, characterized in Ti5Si3 TiAl-based composite material plate according to particle-enhanced methods of preparation are was done as follows:

One, of the Al-Si alloy foil with pure Ti foil are alternately stacked, and placed on a vacuum hot press furnace, at a temperature of 300 °C -500 °C and a pressure of 10 mpa-30 mpa hot press is performed under the conditions of 0.5h-2h, resulting in a multilayer Ti-(Al-Si) composite sheet;

Second, the step of a multi-layer made of Ti-(Al-Si) composite plate materials at a temperature of 500 °C -800 °C heat treatment under conditions of a pressure less 5h-30h, to give a Ti (Al, Si)3 solid solution composite sheet;

Three, step two the yield of the Ti (Al, Si)3 solid solution composite sheet at a temperature of 900 °C -1200 °C and a pressure of 10 mpa-50 mpa heat treatment under the conditions of 5h-40h, to give Ti5Si3 TiAl-based composite material plate according to a particle enhanced crude;

Four, the step three resulting Ti5Si3 TiAl-based composite material plate according to a particle enhanced crude at a temperature of 1400 °C and a pressure of 10 mpa-30 mpa lower sheets layered heat treatment conditions of 0.1h-0.5h, i.e. to give Ti5Si3 TiAl-based composite material plate according to a particle enhanced.

2. One Ti5Si3 TiAl-based composite material particle enhanced process for the preparation of the sheet material according to claim 1, characterized in step one Al-Si alloy foil to Al -6Si alloy foil, Al -4Si alloy foil or Al -2Si alloy foil.

3. One Ti5Si3 TiAl-based composite material plate according to process for the preparation of the reinforcing particles according to claim 1, characterized in step one Al-Si alloy foil with pure Ti foil alternating stack of laminated layers is a layer 2n + 1, n is a positive integer of less than 200, the outermost layer is a pure Ti foil.

4. One Ti5Si3 TiAl-based composite material plate according to a method for producing a particle-reinforced according to claim 1, characterized in step one Al-Si alloy foil has a thickness of 0.1 mm -1 mm; step one pure Ti foil has a thickness of 0.1 mm -1 mm.

5. One Ti5Si3 TiAl-based composite material plate according to a method for producing a particle-reinforced according to claim 1, characterized in step two in the third step containing Ti obtained in (Al, Si)3 solid solution at a temperature of 900 °C and a pressure of 10 mpa composite sheet of the heat treatment conditions where 5h-40h, to give Ti5Si3 TiAl-based composite material plate according to a particle enhanced crude.

6. One Ti5Si3 TiAl-based composite material production method of particle-reinforced sheet material according to claim 1, characterized in step four the step three resulting Ti5Si3 TiAl-based composite material plate according to a particle enhanced crude at a temperature of 1400 °C and a pressure of 10 mpa-30 mpa 10min lower sheets layered heat treatment conditions, to give a Ti5Si3 TiAl-based composite material plate according to a particle enhanced.

Beta-gamma TiAl alloy and preparation method thereof
CN102828067

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- **International Patent Classification**
  C22C-001/03 C22C-014/00 C22C-030/00
- **Publication Information**
  CN102828067 A 2012-12-19 [CN102828067]
- **Priority Details**
  2012CN-0369708 2012-09-28
- **Fampat family**
  CN102828067 A 2012-12-19 [CN102828067]

- **Abstract:**
  (CN102828067)
  The invention provides a beta-gamma TiAl alloy and a preparation method thereof, relating to a TiAl alloy and a preparation method thereof. The invention mainly solves the problem that the existing TiAl alloy has poor high temperature deformability. The beta-gamma TiAl alloy is prepared from Al, X, A and balance of Ti, wherein X is element Mo or Mn, and A is element B or Y. The preparation method comprises the following steps of: firstly, weighing raw materials in percent by atom; secondly, pouring the raw materials into a vacuum induction melting furnace to be subjected to vacuum melting; and thirdly, pouring an alloy melt into a preheated metal casting mould, thus the beta-gamma TiAl alloy is obtained. The beta-gamma TiAl alloy prepared by adopting the invention improves high temperature deformability of a titanium-aluminium alloy, deformation adopting nearly isothermal sheath forging can reach up to 80%, surface of a prepared forging stock is smooth, internal tissue is thin and uniform, and the prepared forging stock is mainly applied to aviation and automobile industrial materials.

Claims

(CN102828067)

1. One beta-gamma TiAl alloy, characterized in beta-gamma TiAl alloy by atomic percentage is between 38%-43% of the Al, 2%-8% of the X, 0%-2% of the Ti and the balance of A made, wherein X is a Mo or Mn element, A is a B or Y elements.
2. One beta-gamma TiAl alloy according to claim 1, characterized in beta-gamma TiAl alloy by atomic percentage was 38.6%-40% of the Al, 2.5%-4% of the X, 0%-2% of the Ti and the balance of A made, wherein X is a Mo or Mn element, A is a B or Y elements.
3. One beta-gamma TiAl alloy preparation method according to claim 1, characterized in beta-gamma TiAl alloy according to the following steps implemented method for producing:

One, in atomic percentages 38%-43% Al, 2%-8% X, 0%-2% A and the balance Ti, titanium sponge is weighed, high purity aluminum, AlX master alloy and a high-purity A; second, will be water-cooled copper crucible was weighed in step one of the material was placed in the vacuum induction melting furnace, control the chamber vacuum is lower than 10-2mbar, 20min adjusted melting furnace power is increased to 350-400 kw power stops increasing after, insulation 8-20min thereby obtaining an alloy melt; three, the metal mold die is preheated to 200-500 °C, to give the preheated metal mold die, and then the alloy melt was cast into preheated metal casting mold where, in a vacuum induction furnace cooled to room temperature, to give beta-gamma TiAl alloy; Wherein X is a Mo or Mn element step one, A is a B or Y elements, titanium sponge mass purity greater than 99.7%, 99.9% purity aluminum having a purity of the mass, the mass of the master alloy AlX purity greater than 99.5%, the quality of the high-purity A purity greater than 99.9%.

Preparation method of Ti5Si3 particle reinforced TiAl-based composite material plate

CN102744409

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• **Fampat family**

CN102744409	A	2012-10-24	[CN102744409]

• **Abstract:**

(CN102744409)

The invention provides a preparation method of a Ti5Si3 particle reinforced TiAl-based composite material plate, which relates to a preparation method of a TiAl-based composite material plate. The invention is to solve technical problems of complicated preparation process, the need of numerous follow-up machining and distribution nonuniformity of a reinforced body in the traditional method for preparing the particle reinforced TiAl-based composite material plate. According to the invention, the preparation method is carried out in the following steps of: after alternatively laminating an Al-Si alloy plate and a Ti plate, rolling the laminated plates so as to obtain a multi-layer composite plate; and carrying out heat treatment on the multi-layer composite plate so as to obtain the Ti5Si3 particle reinforced TiAl-based composite material plate. The TiAl-based composite material plate prepared according to the invention has the advantages of uniform structure as well as fine and dispersed reinforced body particles and can be used as structural materials in the aerospace field.

Claims
(CN102744409)
1. Ti_5Si_3 TiAl-based composite material plate according to process for the preparation of the reinforcing particles, characterized in Ti_5Si_3 TiAl-based composite material plate according to particle-enhanced methods of preparation are carried out in the following steps:
One, of the Al-Si alloy plate materials and pure Ti placed in a vacuum hot press sintering device implemented by alternately stacking plate, first the vacuum hot press sintering furnace chamber was evacuated to a vacuum degree of 0.01Pa, then warmed to 300-500 °C, and applying 10-30 mpa heated pressing of 0.5-2h, then at 300-500 °C under conditions of hot rolling, preparation of Al-Si/Ti multilayer composite sheet;
Second, a first step of the resulting multilayer composite sheet placed in a vacuum hot press sintering furnace, at 500 °C -700 °C heat treatment under conditions 5-30h, again at 900-1200 °C heat treatment under conditions 5-40h, i.e. to give Ti_5Si_3 TiAl-based composite material plate according to a particle enhanced.
2. Ti_5Si_3 TiAl-based composite material production method of particle-reinforced sheet material according to claim 1, characterized in step one Al-Si alloy and pure Ti plate by alternately stacking of layers is a layer 2n + 1, n is a positive integer of less than 200, the outermost layer is a pure Ti sheet.
3. Ti_5Si_3 TiAl-based composite material production method of particle-reinforced sheet material according to claim 1, characterized in step one Al-Si alloy and pure Ti plates have a thickness of not more than 1 mm.
4. Ti_5Si_3 TiAl-based composite material particle enhanced process for the preparation of the sheet material according to claim 1, characterized in step one in a hot rolling process, each time a reduction amount of 10%-30%.

Preparation method of Ti5Si3/TiAl based composite material
CN102154570

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- **International Patent Classification**
  C22C-001/08

- **Publication Information**
  CN102154570 A 2011-08-17 [CN102154570]
- **Priority Details**
  2010CN-0528583 2010-11-02

- **Fampat family**

CN102154570	A	2011-08-17	[CN102154570]

- **Abstract:**
  (CN102154570)
  The invention relates to a preparation method of a composite material, in particular to a preparation method of a Ti5Si3/TiAl based composite material, which solves the problem that the existing preparation method of the Ti5Si3/TiAl based composite material has high cost. The method comprises the following steps: putting TiH2 powder in a graphite mould to obtain a TiH2 preform; arranging an Al-Si alloy scrap material on the preform; and arranging the graphite mould into a vacuum hotpressing sintering furnace for vacuum pressurization hot junction to obtain the Ti5Si3/TiAl based composite material. The hardness of the composite material prepared by the invention is 4GPa-6GPa, the tensile strength at 700 DEG C is 600MPa-800MPa, and the preparation cost is low. The composite material can be used as a novel high-temperature structural material of aeronautic and aerospace aircrafts.

Claims

(CN102154570)

1. One Ti5Si3/TiAl process for the preparation of the matrix composite material, characterized in Ti5Si3/TiAl-based composite material production method was done as follows: one, in terms of mass percentage were weighed 65%-70% TiH2 powder and 30%-35% of the Al-Si alloy scrap, wherein Al-Si alloy containing Si in an amount of 3.6%-16.7% (mass); second, step one is weighed TiH2 to powder is charged into a graphite mold, to give the TiH2 preform; three, and the Al-Si alloy is subjected to step will be derived TiH2 on the preform, further equipped with a TiH2 preform and Al-Si alloy placed in a vacuum hot press sintering furnace of a graphite mold, by applying vacuum to 0.001Pa-0.01Pa, at 10 °C/min-20 °C/min ramped up to 400 °C -550 °C and retained for 90min-240min, again at 10 °C/min-20 °C/min ramped up to 580 °C -700 °C and retained for 30min-60min, then pressurized to 5 mpa-15 mpa, dwell 5min-30min; four, while keeping the pressure constant conditions further increasing the temperature to 1100-1400 °C and held 1h-4h, and then cooled to room temperature back mode dwell, to give Ti5Si3/TiAl composite material.
2. One Ti5Si3/TiAl-based composite material production method according to claim 1, characterized in step one TiH2 powder having particle diameter of 20 m -60 m irregular powder.
3. One Ti5Si3/TiAl-based composite material production method according to claim 1 or 2, characterized in step one Al-Si alloy trimmings in an amount of Si 4%-15% (by mass).
4. One Ti5Si3/TiAl-based composite material production method according to claim 1 or 2, characterized in percentage by mass was weighed out in step one 66%-69% TiH2 powder and 31%-34% of the Al-Si alloy scrap.
5. One Ti5Si3/TiAl-based composite material production method according to claim 1 or 2, characterized in percentage by mass was weighed out in step one 67% TiH2 powder and 33% of the Al-Si alloy scrap.
6. One Ti5Si3/TiAl-based composite material production method according to claim 1 or 2, characterized in step three the vacuum hot press sintering furnace to a vacuum of 0.002Pa-0.009Pa.
7. One Ti5Si3/TiAl-based composite material production method according to claim 1 or 2, characterized in step three the vacuum hot press sintering furnace to a vacuum of 0.005Pa.
8. One Ti5Si3/TiAl-based composite material production method according to claim 1 or 2, characterized in step three to 12 °C/min -18 °C/min ramped up to 420 °C -530 °C and retained for 100min-220min, again at 12 °C/min-18 °C/min ramped up to 600 °C -680 °C and retained for 35min-55min, then pressurized to 6 mpa-13 mpa, dwell 10min-25min.
9. One Ti5Si3/TiAl-based composite material production method according to claim 1 or 2, characterized in: in the third step 15 °C/min ramped up to 500 °C and retained for 150min to, again heated to 650 °C and retained for 40min to 15 °C/min, then pressurized to 10 mpa, dwell 15min.

Beta type gamma-TiAl alloy and preparation method thereof
CN101880794

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  C22C-001/02 C22C-014/00 C22C-030/00
- **Publication Information**
  CN101880794 A 2010-11-10 [CN101880794]
- **Priority Details**
  2010CN-0224172 2010-07-12

- **Fampat family**

CN101880794	A	2010-11-10	[CN101880794]

- **Abstract:**
  (CN101880794)
  The invention discloses a beta type gamma-TiAl alloy and a preparation method, relates to a TiAl alloy and a preparation method thereof and solves the problems of the high-temperature deformability and poor oxidation resistance of the traditional TiAl alloy. The beta type gamma-TiAl alloy comprises the following components in percentage by atom: 41-46 percent of Al, 9 percent of V and Nb, 0-0.3 percent of Y and the balance of Ti, wherein the specific value x of the V and the Nb is 0.5-5. The preparation method comprises the following steps: weighting raw materials of spongy titanium, high-purity aluminum, an aluminum-niobium intermediate alloy, an aluminum-vanadium alloy and an aluminum-yttrium alloy; and placing the raw materials into a water-cooled copper crucible vacuum medium frequency induction melting furnace for melting. By controlling the proportion of the V to the Nb, the beta type gamma-TiAl alloy with favorable high-temperature deformability and the oxidation resistance can be obtained and the forged surface has no crack phenomenon; and the weight is added by 25mg/cm<2> after circulating oxidation at 800DEG C for 80h, which is ten times of the oxidation resistance of a Ti-43Al-9V-0.3Y alloy. The preparation method is simple.

Claims
(CN101880794)
1. One --TiAl alloy, characterized in --TiAl alloy containing in atomic percentage content of 41%-46% of the Al, Nb V 9% of the sum, 0-0.3% and the balance Ti of the Y, wherein, the ratio of atoms of Nb V and the percentage content of x=0.5-5.
2. One --TiAl alloy according to claim 1, characterized in --TiAl alloy containing in atomic percentage content of 41%-46% of the Al, Nb V 9% of the sum, and the balance of Ti.
3. One --TiAl alloy according to claim 1, characterized in --TiAl alloy containing in atomic percentage content of 43%-46% of the Al, Nb V and a 9% to, 0.1-0.3% of the Y and the balance of Ti.
4. According to claim 1, 2 or 3 -type one -TiAl alloy, characterized in V and the Nb atomic percentage of the ratio x=1-3.
5. According to claim 1, 2 or 3 A --TiAl alloy, characterized in V and the Nb atomic percentage of the ratio x=1.25.
6. One --TiAl alloy preparation method according to claim 1, characterized in --TiAl alloy was prepared by following steps: one, the following raw materials were weighed: titanium sponge, high-purity aluminum, aluminum and niobium master alloy, aluminum v master alloy and yttrium aluminum master alloy; wherein control Al, V, Nb, Ti atoms of the elements Y and the percentage content of 41%-46% of the Al, Nb and a 9% of the V, 0-0.3% of the Ti and the balance of Y, V Nb ratio and the atomic percentage of controlled to 0.5-5; di, a raw material was added to the step of a water-cooled copper crucible weighed vacuum induction melting furnace, and then to 3-8 kw/min increase rate to power up the molten 200-400 kw power stops increasing after melting, then constant smelting power 1-20min resulting melt; three, the melt is cast to a temperature of 200-600 °C in the metal mold, cooled to room temperature, resulting --TiAl alloy.
7. One --TiAl alloy preparation method according to claim 6, characterized in step one in which the control Al, V, Nb, Ti atoms of the elements Y and the content percentage of 43%-46% of the Al, Nb V 9% of the sum, 0.1-0.3% of the Y and the balance of Ti.
8. One --TiAl alloy preparation method according to claim 6 or 7, characterized in step one control V and the Nb atomic percentage ratio of from 1-3.
9. One --TiAl alloy preparation method according to claim 8, characterized in step two and then to 4-6 kw/min increase rate to power up the molten 280-360 kw power stops increasing after melting.
10. According to claim 6, 7 or 9 A --TiAl alloy preparation method, characterized in step two is then constant smelting power 5-15min resulting melt.

TiB2/TiAl composite panel and preparation method thereof
CN101880793

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  C22C-001/00 C22C-014/00 C22F-001/18
- **Publication Information**
  CN101880793 A 2010-11-10 [CN101880793]
- **Priority Details**
  2010CN-0222296 2010-07-09

- **Fampat family**

CN101880793	A	2010-11-10	[CN101880793]

- **Abstract:**
  (CN101880793)
  The invention discloses a TiB2/TiAl composite panel and a preparation method thereof, relating to a particle-reinforced TiAl based composite panel and a preparation method thereof. The TiAl based composite panel prepared by the invention has the advantages of uniform and fine texture, isotropy, little pollution, higher fracture toughness and high-temperature strength, short preparation period, high use rate of materials and low cost. The TiB2/TiAl composite panel comprises TiB2 and TiAl alloy substrates. The preparation method comprises the following steps of (1) preparing a cast ingot, annealing and hot isostatic pressing; (2) cutting into blocks, polishing the surface, spraying with plasmas, packing and vacuum sealing; (3) rolling panels; and (4) turning to remove wraps, and polishing the surface to reduce the thickness to obtain the TiB2/TiAl composite panel. The TiB2/TiAl composite panel of the invention can be used in wing and casing parts of a superspeed aircraft, and can be also used for manufacturing protective tiles of armors.

Claims

(CN101880793)

1. TiB2/TiAl composite material sheet, characterized in TiB2/TiAl composite material plate by the percentage by volume 0.8%-20% TiB2 TiAl alloy matrix and the balance of the composition, wherein the TiAl alloy matrix in atomic percentages by 40%-55% Ti, 43%-48% Al and the balance of alloy elements consisting, alloying element is V, Nb, Cr, Mn, Mo, Si, Y of one or several of which are composed, in the TiAl alloy matrix 9% atomic percentage of V, Nb in the TiAl alloy matrix 4% by atomic percent, the atomic percentage of Cr in the TiAl alloy matrix 4%, Mn in the TiAl alloy matrix 2% atomic percentage of, in atomic percent of Mo in the TiAl alloy matrix 1%, Si in the TiAl alloy matrix 2% by atomic percent, Y in the TiAl alloy matrix 0.3% by atomic percent, a plate thickness of 0.5-6 mm.
2. TiB2/TiAl composite material plate according to claim 1, characterized in TiB2/TiAl composite material plate by the percentage by volume 5%-15% of the TiB2 and the balance of TiAl alloy matrix composition.
3. TiB2/TiAl composite material plate according to claim 1 or 2, characterized in TiAl alloy Ti 49.7% by atomic percentage of the substrate by, 46% of the Al, Nb 2% of the, Cr 0.3% to 2% of the composition and the Y.
4. TiB2/TiAl method for producing a composite material plate according to claim 1, characterized in TiB2/TiAl method for producing a composite material plate according to the following steps: one, will be TiB2/TiAl composite ingot at 800 °C -1200 °C conditions, annealing processing 8-24 hours, and then at 1200-1280 °C, 150-250 mpa conditions, hot isostatic pressing treatment 3-5 hours, wherein the TiB2/TiAl composite ingot on a volume percentage by 0.8%-20% TiB2 and the balance of TiAl alloy matrix composition, wherein the TiAl alloy matrix in atomic percentages by 40%-55% Ti, 43%-48% Al and the balance of alloy elements consisting, alloying element is V, Nb, Cr, Mn, Mo, Si, Y of one or several of which are composed, in the TiAl alloy matrix 9% atomic percentage of V, Nb in the TiAl alloy matrix 4% by atomic percent, the atomic percentage of Cr in the TiAl alloy matrix 4%, Mn in the TiAl alloy matrix 2% atomic percentage of, in atomic percent of Mo in the TiAl alloy matrix 1%, Si in the TiAl alloy matrix 2% by atomic percent, Y in the TiAl alloy matrix 0.3% by atomic percent; di, via step one-treated ingot to be cut, cut to a thickness of 8-15 mm square segments, polished surface, and then plasma spray 0.05-0.2 mm thick Mo or Y2O3, in a square block surface is plasma sprayed coating, and then a thickness of around 4-15 mm by encapsulation of the package, vacuum sealed to the gap, the capsule formed of stainless steel, pure titanium or a titanium alloy; three, and then placed into a furnace, heated to 900-1300 °C, and incubated for 20-50 minutes, and then is rolled in the hot rolling machine, rolling temperature is 900-1300 °C, rolling pressure of 200-600 tons, rolling speed of 0.1-4 m/s, stress concentrates to pass 10-30%, between passes to the furnace 5-30 minutes, total deformation of rolling 60-90%, rolling back to the furnace, furnace cooling to 200-400 °C, and then cooled to room temperature; four, turning to remove the sheath and the plasma sprayed coating, after polishing surfaces having a thickness of 0.5-6 mm of the TiB2/TiAl composite material plate.
5. TiB2/TiAl method for producing a composite material plate according to claim 4, characterized in step one TiB2/TiAl composite ingot using a vacuum arc melting techniques, in combination with a vacuum induction melting technique XD method, vacuum induction melting technique or the smelting technique made of plasma-arc.
6. TiB2/TiAl method for producing a composite material plate according to claim 4 or 5, characterized in step one annealing temperature of 900 °C -1100 °C.
7. TiB2/TiAl method for producing a composite material plate according to claim 4 or 5, characterized in step one annealing temperature of 1000 °C.
8. TiB2/TiAl method for producing a composite material plate according to claim 6, characterized in step one annealing time of 10-20 hours.
9. According to claim 4, 5 or 8 TiB2/TiAl method for producing a composite material plate, characterized in step one hot isostatic pressing at a temperature of 1250 °C, hot isostatic pressing at a pressure of 200 mpa.
10. TiB2/TiAl method for producing a composite material plate according to claim 9, characterized in hot isostatic pressing time 4 hours.

Thinning method for as-cast state TiAl based alloy grain
CN101319297

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- **International Patent Classification**
  C22F-003/00
- **Publication Information**
  CN101319297 A 2008-12-10 [CN101319297]
- **Priority Details**
  2008CN-0064794 2008-06-23
- **Fampat family**
  CN101319297 A 2008-12-10 [CN101319297]

- **Abstract:**
  (CN101319297)
  The invention provides a method for thinning a cast stated TiAl based alloy crystal grain, relating to a method for thinning a TiAl based alloy crystal grain. The method resolves the problems of complicated process, high cost, long cycle and relatively high impurity content in products existing in the prior method for thinning the TiAl based alloy crystal grain. The method comprises the following steps that: parts are assembled, and the cast stated TiAl based alloy base metals are connected with the pulsing current, and the thinning of the cast stated TiAl based alloy crystal grain is completed. The method for thinning the cast stated TiAl based alloy crystal grain has the advantages of no impurity introduced, simple process, low cost and short cycle.

Claims

(CN101319297)

1. TiAl-based alloy crystal grain refinement of one as-cast method, characterized in as-cast TiAl-based alloy crystal grain refinement of the method implemented by the following steps: first, the insulating liner (2) overlaid onto the base plate (7) the upper, as-cast TiAl-based alloy base material (6) put onto dielectric liner (2) the upper, and then the conductive electrode (4) TiAl-based alloy parent material placed in the as-cast (6) the upper, and the conductive electrode (4) and further placing a block on the dielectric liner (2); di, by means of bolts (1) the pressure plate (3) and the bottom plate (7) connected and fastened, a pulsed power source of the external wire, by means of glued screw (5) and the conductive electrode (4) is connected; three, TiAl-based alloy parent material to the as-cast (6) is energized with a 1-20 th pulse current, TiAl-based alloy crystal grain refinement of the as-cast is complete; wherein the maximum current density are pulse current in the third step 1.0x109-10.0x109A/m2, current period is 1-10000s.
2. TiAl-based alloy crystal grain fine method one as-cast according to claim 1, characterized in as-cast TiAl-based alloy parent material in step one (6) is a cast molded workpiece or ingot.
3. TiAl-based alloy crystal grain fine method one as-cast according to claim 1, characterized in as-cast TiAl-based alloy parent material in step one (6) in the content of Al 45at %-51at %.
4. TiAl-based alloy crystal grain fine method one as-cast according to claim 1, characterized in step three current pulses in the maximum current density of 3.0x109-8.0x109A/m2, current period is 100-8000s.
5. TiAl-based alloy crystal grain refinement of one as-cast method according to claim 1, characterized in step three current pulses in the maximum current density to 6.0x109A/m2, current period of 500s.

Directional solidification device for preparing TiAl radicle alloy bloom
CN101112716

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- **International Patent Classification**
  B22D-011/049 B22D-011/10 F27B-014/08
- **Publication Information**
  CN101112716 A 2008-01-30 [CN101112716]
- **Priority Details**
  2007CN-0072716 2007-08-29
- **Fampat family**

CN101112716	A	2008-01-30	[CN101112716]

- **Abstract:**
  (CN101112716)
  A positioning and concreting device for preparing the TiAl-based alloy billet is provided. The invention relates to a positioning and concreting device preparing the TiAl-based alloy billet. The invention solves the problem that the prior art can not produce the TiAl-based billet with the cross-section square. the invention includes an enclosed furnace body in which the upper end part of a mother material rod is fixed to the lower end part of a material feeding rod; the lower end part of the mother material rod is extended in a water-cooling copper pot; a material-final rod is arranged in a crystallizer below the water-cooling copper pot and a refrigerant material is filled between the material-final rod and the crystallizer; a material move rod is supported at the lower end of the material-final rod; the exterior of the water-cooling copper pot is encircled with an induction coil used for exciting an alternating magnetic field and producing the heat area required by the manufacturing procedure by diffusion of the water-cooling copper pot to the interior; the horizontal cross-section of the water-cooling copper pot internal chamber is square, and the round angle transition is arranged between any two edges of the squares.

Claims

(CN101112716)

1. Preparing a TiAl-based alloy billet of one directional solidification apparatus, which includes an enclosed furnace body (22), a feed lever (21), a water-cooled copper crucible (12), the crystalizer (6), shift rod material (4), the induction coil (11), a coolant material (7), a master rod (14) and the material rod end (8), located in the furnace body (22) of a master batch in the rod (14) fixed onto the upper end of a feed lever (21) the lower end portion, a master rod (14) at the lower end of the water-cooled copper crucible ministry stretch (12) in which, material rod end (8) provided in the water-cooled copper crucible (12) the lower mold (6) and that material rod end (8) to the mold (6) are filled with a coolant material (7), shift rod material (4) received in material rod end (8) of the lower end, a water-cooled copper crucible (12) wraps around the outside of an induction coil (11) and through the water-cooled copper crucible for exciting the alternating magnetic field (12) to the inside thereof so as to generate machining processes required for the diffusion of the hot zone (23), characterized in water-cooled copper crucible (12) has a square horizontal cross-section of the lumen, is provided between any two of the sides of the square are rounded transition.

2. Preparing a TiAl-based alloy billet of one directional solidification apparatus according to claim 1, characterized in radius of curvature of the rounded corner transition

mrow mi R /mi mo = /mo mfrac mrow mn 2 /mn msup mi d /mi mn 2 /mn /msup /mrow msub mi H /mi mn 0 /mn /msub /mfrac msqrt mi s /mi msub mi q /mi mn 0 /mn /msub /msqrt /mrow ,In the formula q0-- an induction heating power per unit volume to be molten material absorbs;

R--radius of curvature; H0-- unit volume is molten material of the magnetic field strength; s--conductivity material to be tapped; d--molten material penetration depth of electrical current by.

3. Preparing a TiAl-based alloy billet of one directional solidification apparatus according to claim 1, characterized in coolant material (7) is a binary alloy slurry or ternary alloy slurry, in percent by mass, a binary alloy solution as a Ga -24.5% and the In -75.5%; ternary alloy solution as a Ga -25%, In -13% and the Sn -62%.

4. Preparing a TiAl-based alloy billet of one directional solidification apparatus according to claim 1, characterized in water-cooled copper crucible (12) of the means of a magnetic path (12-3) arranged along a water-cooled copper crucible (12) provided in the height direction, a plurality of through the flux path (12-3) are parallel to and along the water-cooled copper crucible (12) distributed equally about the outer surface according to, means of a magnetic path (12-3) for water-cooled copper crucible by penetrating through (12) between the inner surface and an outer surface of the elongated hole (12-3-1) and filling into the elongated hole (12-3-1) of the mica flakes (12-3-2) composition, long holes (12-3-1) a cross-sectional shape of the inner narrow "triangular" outer width.

5. Blooms TiAl-based alloy prepared by a directional solidification apparatus according to one of according to claim 4, characterized in long holes (12-3-1) a cross-sectional shape of a "triangular connectively rectangular", provided in the crucible body "triangular" (1) and which communicates with the outer surface of the top corners of "rectangular" "triangular" the short side.

6. Alloy billets of one directional solidification preparing TiAl-based device according to claim 1, characterized in that it further comprises a resistive heating the preheater (14), lies opposite the preheater (14) provided in the water-cooled copper crucible (12) in the master batch and around the upper end of the rod (14) on the lower end of.

7. Preparing a TiAl-based alloy billet of one directional solidification apparatus according to claim 1, characterized in that it further comprises a cylindrical stainless steel screens (24), a stainless steel screen (24) disposed in the water-cooled copper crucible (12) between and around the upper end of the lower end of the mold 6 material rod end (8) of the upper end.

Method for preparation of Yt-containing TiAl intermetallic compound plate material

CN101011705

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- **International Patent Classification**
  B21B-001/38 B21B-003/00 B21B-037/00 B21B-037/46 B21B-037/48 B21B-037/74 C21D-001/00 C21D-009/70 C21D-011/00
- **Publication Information**
  CN101011705 A 2007-08-08 [CN101011705]
- **Priority Details**
  2007CN-0071709 2007-01-31
- **Fampat family**

CN101011705	A	2007-08-08	[CN101011705]

- **Abstract:**
  (CN101011705)
  The invention discloses a making method of TiAl metal compound board with yttrium, which comprises the following steps: 1. fusing TiAl metal block with 0.01-0.6at.% yttrium; 2. making jacket through stainless steel or titanium alloy; 3. placing block in the jacket after heating; 4. placing TiAl metal compound block in the heating furnace to 950-1320 deg.c; rolling; cooling to indoor temperature; 5. removing jacket; obtaining the product.

Claims

(CN101011705)

1. TiAl intermetallic compound of the element yttrium-containing process for the preparation of the sheet material, characterized in the method the steps of:

Step one, and the yttrium content is 0.01-0 . 6at.%, the aluminum content was 35-55at.%, a titanium content of 44.9-64 . 4at.% fusion-cast obtained containing 0.01-0 . 6at.% yttrium element of the intermetallic compound TiAl ingots, ingots required within 800 °C -1200 °C under conditions, for 10-80 hours of annealing treatment, at 1200-1280 °C, 150-250 mpa conditions, was 3.5-4.5 hours hot isostatic pressing treatment, and then is cut out from ingots square blank; or from the heat-treated, the obtained yttrium-containing elements working such as hot forging or extrusion 0.01-0 . 6at.% of a TiAl intermetallic compound material cut out from a square blank;

Step two, selected from stainless steel, pure titanium or titanium alloy as the sheath material, made sheath, the sheath of the single-sided thickness of 2 mm -30 mm, the envelope of the two upper and lower block, an intermediate in a rectangular groove;

Step three, the step-containing 0.01-0 . 6at.% yttrium element of the intermetallic compound TiAl blank square, upper and lower two sheath material encased within a rectangular slot formed in the middle, both upper and lower envelope with a stainless steel or titanium alloy wire welding flat at the junction of dedicated, a cubic shaped unitary material;

Step four, the step three is made of stainless steel, pure titanium or a titanium alloy sheath wrapped containing 0.01-0 . 6at.% yttrium element of the intermetallic compound TiAl the overall material charged into a furnace heated to 950-1320 °C, and retained for 10-60 minutes, then placed in a hot rolling machine for rolling, rolling temperature of 950-1320 °C, rolling pressure of 200-600T, rolling speed of 0.1-2 m/s, stress concentrates to pass 5-25%, between passes to the furnace 5-35 minutes, total deformation of rolling 70-92%, after rolling to the furnace, the oven was cooled to 300-950 °C, and then cooled to room temperature;

And a fifth step, removal of the sheath, TiAl intermetallic compounds containing yttrium plate materials of the elements is obtained.

2. TiAl intermetallic compound of the element yttrium-containing process for the preparation of the sheet material according to claim 1, characterized in step one in the intermetallic compound TiAl italsocontains in the Nb, Cr, Mn, V, Ni, W, Hf, Ta, Mo, Zr, Si, Y, La, Ce, C, B of one or more of the elements, the total content of element added is less than 20at. %.

3. TiAl intermetallic compound of the element yttrium-containing process for the preparation of the sheet material according to claim 2, characterized in will be obtained by melt casting process step one Ti -47Al-2Nb-2Mn-0 . 2Yat.% alloy ingot, having a thickness of 10 mm, at 800 °C conditions, so as to warm annealing process 48 hours, at 1250 °C, 170 mpa conditions, hot isostatic pressing treatment for 4 hours, then cut into square shaped blank; step three, 304 stainless steel encased in a sheath of the square billet inside, the sheath has a thickness of 6 mm, step four, placed in a heat treatment furnace heated to 1050 °C, and retained for 30 minutes later, 500x846mm two-high reversible hot rolling mill placed in the upper, rolling pressures as 400T, rolling speed of 0.5 m/s, 10% amount of the flow passes, between passes to the furnace 15 minutes, after rolling to the furnace, the oven was cooled to 600 °C, and then air cooled to room temperature, mechanical turning to remove the sheath, having a thickness of 2.2 mm of the Ti -47Al-2Nb-2Mn-0 . 2Yat.% alloy sheet material, rolled total deformation of 78%.

4. TiAl intermetallic compound of the element yttrium-containing sheet manufacturing method according to claim 2, characterized in will be obtained by a forging process step one Ti -45Al-5Nb-0 . 25Yat.% alloy cake timber, having a thickness of 8 mm, under conditions at 900 °C, 40 hours of heat treatment of heating, and then cut into square shaped blank; step three, a square blank encased within Ti -6Al-4V alloy by encapsulation of the inner, sleeve has a thickness of 8 mm; step four the package Ti -45Al-5Nb-0.25Y alloy cake timber capsule is placed in the heat treatment furnace heated to 1100 °C, and incubated for 40 minutes later, placed in two-high reversible hot rolling mill on the 500x846mm, rolling pressure of 450T, rolling speed of 0.7 m/s, 8% amount of the flow passes, between passes to the furnace 20 minutes, after rolling to the furnace, the oven was cooled to 800 °C, and then cooled to room temperature, mechanical turning to remove the sheath, having a thickness of 1.5 mm of the Ti -45Al-5Nb-0 . 25Yat.% alloy plate materials, total deformation of rolling 79.13%.

5. Of the element yttrium-containing intermetallic compound TiAl method of producing sheet material according to claim 1, characterized in placing the first step the resulting Ti -46.5Al-0.2Y alloy ingots, having a thickness of 10 mm, under conditions at 1000 °C, 40 hours of heat treatment of heating, at 1270 °C, 160 mpa conditions, 3.5 hours hot isostatic pressing treatment is performed, and then cut into square shaped blank; step three, a square blank encased within the inner envelope of the pure titanium, the sleeve has a thickness of 8 mm; step four, the package Ti -46.5Al-0.2Y which the sheath alloy billet placed in heat-treatment furnace heated to 1150 °C, and retained for 30 minutes later, 500x846mm two-high reversible hot rolling mill placed in the upper, rolling pressure of 500T, rolling speed of 0.9 m/s, 11% amount of the flow passes, between passes to the furnace 15 minutes, after rolling to the furnace, furnace cooling to 650 °C, and then air cooled to room temperature, using a mechanical turning to remove the sheath, having a thickness of 1.4 mm of the Ti -46.5Al-0 . 2Yat.% alloy sheet material, rolled total deformation of 86%.

Method for composite preparation of Ti alloy/TiAl alloy composite plate material by using laminated rolling-diffusion method

CN101011706

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- **International Patent Classification**
  B21B-001/38 B21B-003/00 B21B-037/00 B21B-037/74 B21B-047/00 C21D-009/46 C21D-011/00
- **Publication Information**
  CN101011706 A 2007-08-08 [CN101011706]
- **Priority Details**
  2007CN-0071716 2007-01-31
- **Fampat family**
  CN101011706 A 2007-08-08 [CN101011706]

- **Abstract:**
  (CN101011706)
  The invention discloses a making method of titanium alloy/TiAl composite board, which is characterized by the following: overlapping A (titanium foil) and C (aluminium foil); placing at least one layer B (titanium or titanium alloy foil, titanium or titanium alloy board) on the upper and lower surfaces of overlapped layer or among overlapping layer; setting adjacent layer C to B; adopting three layers or more of A or B as the most outer layer; jacketing; rolling under 20-750 deg.c and 750-1300 deg.c.

Claims

(CN101011706)

1. Laminated rolled-diffusion/TiAl alloy composite sheet composite preparation method of titanium alloy, characterized in laminated rolled-diffusion/TiAl alloy composite sheet material to the titanium alloy composite prepared in the following steps of the method is implemented: one, prepared an original material: raw material is a titanium foil: hereinafter referred to as A, titanium or titanium alloy foil, titanium or titanium alloy plate materials: hereinafter referred to as B, aluminum foil: hereinafter referred to as C, A has a thickness of 0.02-0.3 mm, B has a thickness of 0.31-3 mm, C has a thickness of 0.02-0.3 mm; second, laminated: C put in layers with A, at least one layer in the stack B, B or in the laminate an upper, a lower surface, or placed in laminates; stack, adjacent layers of B to C, A or B as the outermost layer, A, B and a C 3 stacked layer number is 3 or more layers; three, envelope: stacks provided outside with a stainless steel, pure titanium or a titanium alloy sheath, the laminate was placed in a stainless steel, pure titanium or titanium alloy plate is welded into a cube container, the cubic container through the evacuation of the vacuum is lower than 1Pa, then welded closed; four, rolling: material goes through the whole of the capsule, is rinsed with at 20-750 °C cold rolling, the whole material placed into a furnace heated to 20-750 °C, and retained for 5-40 minutes, and then quickly placed in the open rolling mill, stress concentrates to pass 2-20%, between passes to the furnace 2-25 minutes, rolled total deformation of 30-70%; followed by 750-1300 °C high-temperature rolling, the whole material be charged into a furnace and heated to 750-1300 °C, and retained for 5-40 minutes, and then quickly placed in the open rolling mill, stress concentrates to pass 2-20%, between passes to the furnace 2-25 minutes, rolled total deformation of 30-80%, the overall material after rolling at 750-1300 °C with furnace cooled to 400-600 °C, and then cooled to room temperature; five, sheath removed: a method of manufacturing the capsule is removed using machines, to obtain titanium alloy/TiAl alloy composite sheet.
2. Laminated rolled-diffusion/TiAl alloy composite preparation method of titanium alloy composite sheet according to claim 1, characterized in A has a thickness of 0.05 mm, B has a thickness of 1 mm, C has a thickness of 0.05 mm.
3. Laminated rolled-diffusion/TiAl alloy composite preparation method of titanium alloy composite sheet according to claim 1, characterized in A has a thickness of 0.07 mm, a thickness of 1.5 mm B, C has a thickness of 0.07 mm.
4. Laminated rolled-diffusion/TiAl alloy composite preparation method of titanium alloy composite sheet according to claim 1, characterized in lamination step, with the C put in layers A, 5 C respectively with the A layer, B is one layer, with the lower surface of the C A B placed in a stack, the stack, adjacent layers of B to C, the upper surface of the outermost layer A.
5. Laminated rolled-diffusion/TiAl alloy composite preparation method of titanium alloy composite sheet according to claim 1, characterized in lamination step, A with C put in layers, are respectively 7 A to C 8 layer and layer, layer B is a 2, A C B layer 1 with the lower surface of the stack placed within, on the other 1 A and the C stack layers are disposed on an intermediate, stack, adjacent layers of B to C, the upper surface of the outermost layer A.
6. Laminated rolled-/ TiAl alloy composite sheet material to the titanium alloy composite prepared diffusion method according to claim 1, characterized in rolling step, 20% amount of the flow pass, rolling total deformation of 50%.
7. Laminated rolled-/ TiAl alloy composite prepared titanium alloy composite sheet of the diffusion method according to claim 1, characterized in rolling step, stress concentrates to pass at a 10%, 10 minutes between passes to the furnace, a rolling total deformation of 40%.
8. Laminated rolled-titanium alloy/TiAl alloy method of preparing the composite board are diffusion composite according to claim 1, characterized in rolling step, stress concentrates to pass 8%, 15 minutes between passes to the furnace, a rolling total deformation of 60%.
9. Laminated rolled-diffusion/TiAl alloy composite preparation method of titanium alloy composite sheet according to claim 1, characterized in rolling step, stress concentrates to pass at a 10%, 15 minutes between passes to the furnace, a rolling total deformation of 50%.
10. Laminated rolled-diffusion/TiAl alloy composite preparation method of titanium alloy composite sheet according to claim 1, characterized in monolithic material after rolling over 1000 °C to 500 °C in the furnace is cooled down, and then air cooled to room temperature.

Preparing method of Ti Al-based alloy plate
CN101758236

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- **International Patent Classification**
  B21B-001/38 B21B-037/46 B21B-037/48 B22F-003/16

- **Publication Information**
  CN101758236 A 2010-06-30 [CN101758236]
- **Priority Details**
  2010CN-0300480 2010-01-20

- **Fampat family**

CN101758236	A	2010-06-30	[CN101758236]
CN101758236	B	2011-09-21	[CN101758236B]

- **Abstract:**
  (CN101758236)
  The present invention discloses a preparing method of a Ti Al-based alloy plate, which relates to a preparing method of an alloy plate. The present invention solves the problems that the existing Ti Al-based alloy is not easy to process into to form at room temperature; Ti Al-based alloy plates prepared by powder metallurgy technique are easy to pollute by interstitial elements with many impurities containing oxygen; and Ti Al-based alloy plates prepared by casting metallurgy technique and precision casting art have the disadvantages of crude grain structure, low strength and loose structure.In the method, pure titanium grains are piled in a steel module to obtain a multi-hole titanium prefabricated body; an Al-Si alloy casting wire is cut into block bodies; the block bodies are arrangedon the multi-hole titanium prefabricated body to be sintered to obtain a Ti - Al double alloy complex body; the Ti - Al double alloy complex body is coldrolled to obtain a Ti - Al double alloy complex plate; the Ti - Al double alloy complex plate is sintered again, and is cooled to room temperature; the Ti - Al double alloy complex plate is retreated from the steel module to obtain the Ti Al-based alloy plate. The Ti Al-based alloy is processed to be formed at the room temperature, so the Ti Al-based alloy plate has the advantages of compaction, even structure, thin grain structure and high strength, and the negative effect of oxidation and impurities is reduced.

Claims

(CN101758236)

1. One method for producing TiAl-based alloy plate materials, characterized in TiAl-based alloy plate materials in the production method according to the following steps: one, with a diameter of 50-150 m pure titanium particles deposited directly into steel molds, resulting porous titanium preform; di, and the Al-Si alloy ingot is cut into the steel mold shape dimension comparable bulk, porous titanium preform is then placed over, and then placed in a vacuum hot press sintering furnace, evacuated to 0.001-0.01Pa, and then to 10-20 °C/min ramped up to 590-640 °C and incubated for 30-120min, then pressurized to 5-30 mpa, the packing 10-30min, and then pressure-holding cooling to room temperature, resulting Ti-Al-metal composite body; three, Ti-Al was cold-rolled bimetallic complex, resulting thickness of 1-3 mm of the Ti-Al bimetallic composite panel; four, Ti-Al placed in a vacuum hot press sintering device implemented bi-metallic composite panel, at a temperature of 640-700 °C, a pressure of 10-30 mpa sintered under the conditions of 0.5-3h, the temperature was raised to 1100-1400 °C, at a pressure of 10-30 mpa sintered under the conditions of 1-4h, pressure-holding cooling to room temperature back mode, to give a TiAl-based alloy plate materials; wherein in the third step of cold rolling with the proviso that the rolling pressure of 200-600T, the rolling speed of 0.1-2 m/s, pass deformation of 5%-15%, the rolling total deformation of 70%-95%.
2. Preparation of TiAl-based alloy plate materials A method according to claim 1, characterized in step one with a diameter of 60-140 m pure titanium particles.
3. Preparation of TiAl-based alloy plate materials A method according to claim 1, characterized in pure titanium particles having a diameter of 80 m is employed in step one.
4. One method for producing TiAl-based alloy plate materials according to claim 1, characterized in pure titanium particles having a diameter of 120 m is employed in step one.
5. According to claim 2, 3 or 4 A method for producing TiAl-based alloy plate materials, characterized in 0.005Pa evacuated to the second step, and then ramped up to 600 °C to 15 °C/min and incubated 60min, then pressurized to 10 mpa, dwell 15min.
6. According to claim 2, 3 or 4 A method for producing TiAl-based alloy plate materials, characterized in 0.008Pa evacuated to the second step, and then heated to 620 °C and retained for 100min to 18 °C/min, then pressurized to 30 mpa, dwell 12min.
7. TiAl-based alloy plate materials A method of manufacturing according to claim 6, characterized in cold-rolling in the third step is a rolling pressure of 300T, rolling speed of 0.5 m/s, 8% amount of the flow pass, rolling total deformation of 80%.
8. TiAl-based alloy A method for producing a sheet material according to claim 6, characterized in cold-rolling in the third step is a rolling pressure of 500T, rolling speed of 1.5 m/s, 10% amount of the flow pass, rolling total deformation of 90%.
9. TiAl-based alloy A method for producing a sheet material according to claim 7 or 8, characterized in step four at a temperature of 650 °C, sintered under the conditions of a pressure of 15 mpa 1h, the temperature was raised to 1200 °C, sintered under the conditions of a pressure of 20 mpa 2h.
10. One method for producing TiAl-based alloy plate materials according to claim 7 or 8, characterized in step four at a temperature of 680 °C, sintered under the conditions of a pressure of 25 mpa 2h, then warmed to 1300 °C, sintering under conditions at a pressure of 28 mpa 3h.

Casting method of large size hole defect less TiA1 base alloy ingot CN1718323

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• **Fampat family**

CN1718323	A	2006-01-11	[CN1718323]
CN1319681	C	2007-06-06	[CN1319681C]

• **Abstract:**
(CN1718323)
A smelting-casting method for casting large-size TiAl-based alloy ingot without pores includes such steps as preparing consumable electrode of TiAl-based alloy by ISM technology, resmelting the TiAl-based alloy electrode and casting TiAl-based alloy ingot. It features high uniformity and large size.

Claims

(CN1718323)

1. A large size of the TiAl based alloy ingot no hole defects of the casting method, it comprises the following two steps: a, using a water-cooled copper crucible (2) vacuum induction skull melting TiAl-based alloy consumable electrode melting technology; b, since the vacuum arc melting technique using TiAl-based alloy electrode is remelted and electricity producing TiAl-based alloy ingot; characterized in water-cooled copper crucible (2) vacuum induction skull melting TiAl-based alloy casting art consumable electrode by the following steps are completed: a ', TiAl-based alloy melting of the raw material: titanium sponge was (3) placed in a water-cooled copper crucible (2) arrange preferably, titanium sponge (3) from the upper end of a water-cooled copper crucible (2) leaving the top of 1/4-1/3 of the space, and then the lower aluminum block (6), master alloy (5), the upper layer aluminum block (4) are placed in order from bottom to top of the buried titanium sponge (3) centrally inside, would take up the water-cooled copper crucible (2) of the vacuum chamber was evacuated to 0.01-1Pa, argon-filled to 500-1200Pa, then evacuated to 0.01-1Pa, this is repeated three times, will always be water-cooled copper crucible (2) keep the vacuum level within 0.01-1Pa between, water-cooled copper crucible is turned on after (2) power supply, water-cooled copper crucible will be (2) melting the alloy raw material, the power supply frequency is controlled to 5-7kHz between, power controlled at 150-350 kw between, increases the rate of supply power to 0. 5 kW/s, incubated for 5-10min, and the power was reduced to 200-300 kw, incubated for 3-5min; b' , TiAl-based alloy casting of the electrode: the electrode tip (1) on the outer surface of the TiAl-based alloy melt under casting, each casting has a length (L) for 15-35 cm, casting temperature of 1550-1650 °C, ensure that each furnace melt composition difference 0.2%, TiAl-based alloy ingot after casting of the electrode (7) in a vacuum chamber is cooled to 300 °C or less, to the vacuum chamber is filled air, TiAl based alloy ingot is taken out (7), this is repeated, until a desired electrode length.
2. TiAl based alloy ingot no hole defect of the large size of the casting method according to claim 1, characterized in a 'step of the titanium sponge (3) from the upper end of a water-cooled copper crucible (2) upperly leaving 1/3 of the space, water-cooled copper crucible will accommodate (2) of the vacuum chamber was evacuated to 0.5Pa, argon-filled to 850Pa, then evacuated to 0.5Pa, this is repeated three times, water-cooled copper crucible containment are always (2) the degree of vacuum of the vacuum chamber remains within 0.5Pa, water-cooled copper crucible (2) a power supply having a frequency of 6kHz, increases the rate of supply power to 0. 5 kW/s, a power supply having a power of 300 kw, insulation 10min, and the power was reduced to 250 kw, insulation 5min; b' step each time the length of the overmoulded electrodes (L) to 30 cm, the pouring temperature of 1600 °C, TiAl based alloy ingot after the pouring of (7) in a vacuum chamber was cooled to 250 °C.
3. TiAl based alloy ingot no hole defect of the large dimensions of the casting method according to claim 1, characterized in b ' step of the electrode head (1) using TC4 alloy material.

Method for preparing TiBW-Ti3Al composite material plate with laminated structure

CN103302924

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- **International Patent Classification**
  B22F-007/04 B32B-015/04 B32B-037/06 B32B-037/10
- **Publication Information**
  CN103302924 A 2013-09-18 [CN103302924]
- **Priority Details**
  2013CN-0275779 2013-07-03

- **Fampat family**

CN103302924	A	2013-09-18	[CN103302924]

- **Abstract:**
  (CN103302924)
  The invention discloses a method for preparing a TiBW-Ti3Al composite material plate with a laminated structure and relates to a method for preparing composite material plates. The invention aims to solve the technical problems that the Ti3Al-based alloy plate is difficult to form and insufficient in high-temperature performance. The method comprises the following steps: 1, preparing mixed powder; 2, preparing a TiBW/Ti composite material; 3, preparing a TiBW/Ti composite material foil with the thickness of 100-650mu m; 4, preparing a TiAl3 phase; 5, preparing the TiBW-Ti3Al composite material plate with the laminated structure. According to the method, near-net forming of the high-performance TiBW-Ti3Al-based composite material plate with the novel laminated structure can be finished at a time, direct deformation processing of the brittle Ti3Al-based alloy ingots is avoided, the production process is simple and feasible, the cost is low, and the prepared plate is low in oxygen content. The process is applied to the field of preparation of Ti3Al-based composite materials.

Claims

(CN103302924)

1. A layered structure of the TiBW-Ti3Al method for producing a composite material plate, characterized in layered structure of the TiBW-Ti3Al composite sheet was prepared in the following steps:

One, will be 2.0-5.0g of the TiB2 powder and 190-200g of the Ti powder was placed in mix flour milling is carried out in a planetary ball mill, with a speed of 100-300 rpm under mixed powder 3-10h, to obtain a mixed powder; wherein, the ball-powder ratio of the mixed powder 3-8:1;

Second, the step of a resulting mixed powder was at a temperature of 800-1200 °C, a pressure of 10-50 mpa of incubating 0.2-1h was subjected to vacuum hot press sintering, to prepare a TiBW/Ti composite material;

Three, and the second step of preparing of the TiBW/Ti 50x50mm of the composite material is cut into foil material, sanded 15 vol.% HF solution and the acid washing, ultrasonic washing was placed in an acetone solution and blown dry, having a thickness of 100-650 m of the TiBW/Ti composite foil;

Four, will 3-16 block having a thickness of 50-200 m of the Al foil was cut into a size 50x50mm foil of pure, 10 wt.% NaOH solution used after alkaline cleaning, ultrasonic cleaning in acetone solution was placed and blown dry, and then mixed with 4-17 block step three giving a thickness of 100-650 m of the TiBW/Ti composite foil are alternately stacked to wrap and placed in a graphite mold, and then the graphite mold placed in a vacuum hot press sintering furnace, directly heated up to 800-1200 °C incubated for 0.5-5h, a pressure of 0-0.5 mpa, generate a TiAl3 phase; wherein, by the capsule is made of pure titanium;

Five, the step four generated TiAl3 phase further increasing the temperature to 1200-1400 °C incubated for 0.5-10h, a pressure of 10-80 mpa, i.e. to prepare a layered structure of the TiBW-Ti3Al composite material plate.

2. A layered structure of the TiBW-Ti3Al method for producing a composite material plate according to claim 1, characterized in step one with a speed of 150 rpm was mixed powder 5h.

3. A layered structure of the TiBW-Ti3Al method for producing a composite material plate according to claim 1, characterized in a first step of milling the mixed powder-powder ratio 5:1.

4. A layered structure of the TiBW-Ti3Al method for producing a composite material plate according to claim 1, characterized in step two at a temperature of 1200 °C, incubated under conditions of a pressure of 25 mpa 0.6h.

5. A layered structure of the TiBW-Ti3Al method for producing a composite material plate according to claim 1, characterized in step four Al foil with TiBW/Ti"sandwich" composite foil alternatively arranged in a layered structure, that the uppermost and lowermost ends to TiBW/Ti composite foil.

6. A layered structure of the TiBW-Ti3Al method for producing composite material plate according to claim 1, characterized in step four incubation temperature was elevated to 1200 °C 1.5h.

7. A layered structure of the TiBW-Ti3Al method for producing a composite material plate according to claim 1, characterized in step four pressure of 0 mpa.

8. A layered structure of the TiBW-Ti3Al method for producing a composite material plate according to claim 1, characterized in step five temperature was elevated to 1300 °C insulation 2h.

9. A layered structure of the TiBW-Ti3Al method for producing a composite material plate according to claim 1, characterized in step five the pressure of 50 mpa.

Net-structure TiBw/Ti composite material provided with TiAl3 protecting layer on surface and preparing method thereof

CN105002448

• Patent Assignee HARBIN INSTITUTE OF TECHNOLOGY • Inventor HUANG LUJUN XIE YINGYING LI XINTING CUI XIPING GENG LIN • International Patent Classification C22C-047/08 C22C-049/11 C22C-049/14 C22C-101/22	• Publication Information CN105002448 A 2015-10-28 [CN105002448] • Priority Details 2015CN-0333124 2015-06-16

• Fampat family

CN105002448	A	2015-10-28	[CN105002448]

• Abstract:

(CN105002448)

The invention provides a net-structure TiBw/Ti composite material provided with a TiAl3 protecting layer on the surface and a preparing method thereof, and relates to a net-structure Ti-based composite material with a protecting layer and a preparing method thereof. The composite material solves the problems that a current net-structure TiBw/Ti composite material is poor in high-temperature oxidation resistance and ablation resistance, the traditional process of preparing a TiAl3 clad layer on the surface of a Ti alloy is complex, the requirement is strict, the requirement for equipment is high, binding force of the clad layer and a solid phase is weak, the preparation period is long, many holes are generated, the TiAl3 clad layer is not compact, after the TiAl3 clad layer is heated, more cracks always exist to form oxygen diffusion paths, and as a result, a TiAl3 coating on the surface of a large-sized work-piece falls. A TiBw/Ti composite material is adopted as a base material of the composite material, and the surface of the composite material is provided with the compact TiAl3 layer. The preparing method comprises the steps of polishing, acid corroding, hot dip aluminizing, low-temperature reaction heat treatment and alkalinity treatment. According to the preparing method, the application range of the net-structure TiBw/Ti composite material as a light, heat-resisting and high-strength structure material in a high-temperature environment is widened.

Claims

(CN105002448)

1. Surface has a $TiAl_3$ TiBw/Ti composite material mesh structure of a protective layer, characterized in the composite material as a base material in the TiBw/Ti composite material, the surface has a dense $TiAl_3$ layer; TiB whiskers embedded and the substrate surface $TiAl_3$ layer; wherein, TiB whiskers have a netlike reinforcement phase distribution.

2. Claim 1 surface having a $TiAl_3$ TiBw/Ti composite material production method of a network structure of a protective layer, characterized in surface has a $TiAl_3$ protective layer of a mesh structure TiBw/Ti composite material was prepared as follows:

One, net-like structure TiBw/Ti composite surface polishing, followed by acidic etching solution to surface finish TiBw/Ti composite material are eroded of a mesh structure;

Second, hot-dip aluminum: the pure aluminum is heated to melt and maintain the temperature 900 °C, and then the step an acid etched mesh structure in the TiBw/Ti composite material was immersed in molten aluminum pad;

Three, low-temperature reaction heat treatment: hot-dip aluminum processing goes through step two composite materials are placed in a temperature of 550-660 °C holding time in an environment 2-8h;

Four, three low-temperature heat processing through the steps of a composite material into an alkaline solution reaction, to give a surface having a $TiAl_3$ TiBw/Ti composite protective layer of a mesh structure.

3. Surface has a $TiAl_3$ TiBw/Ti composite material production method of a network structure of a protective layer according to claim 2, characterized in step one acidic etching solution of 5% HF by volume percentage by which, of a 15% HNO_3 and a 80% H_2O composition.

4. Surface has a $TiAl_3$ TiBw/Ti composite material production method of a network structure of a protective layer according to claim 3, characterized in step one surface polished network structure TiBw/Ti composite acidic corrosion time of 5-15s.

5. Surface has a $TiAl_3$ protective layer process for producing a net-like structure TiBw/Ti composite material according to claim 2, characterized in acidic etched mesh structure in step two TiBw/Ti composite material was immersed in the molten aluminum pad 10-60min.

6. Surface has a $TiAl_3$ method for producing a net-like structure TiBw/Ti protective layer composite material according to claim 2, characterized in step four basic solution is NaOH solution concentration is 15% by volume.

7. Surface has a $TiAl_3$ TiBw/Ti composite material production method of a network structure of a protective layer according to claim 2, characterized in step two pure aluminum is melted under heating, a temperature of 700-900 °C.

Component preparation method through beta-gamma titanium-aluminum alloy prealloy powder spark plasma sintering

CN104550956

• Patent Assignee HARBIN INSTITUTE OF TECHNOLOGY • Inventor KONG FANTAO ZHOU HAITAO CHEN YUYONG WANG XIAOPENG • International Patent Classification B22F-003/105	• Publication Information CN104550956 A 2015-04-29 [CN104550956] • Priority Details 2015CN-0028125 2015-01-20

• Fampat family

CN104550956	A	2015-04-29	[CN104550956]

• Abstract:

(CN104550956)
The invention relates to a component preparation method through beta-gamma titanium-aluminum alloy prealloy powder spark plasma sintering and relates to the component preparation method. The invention aims at solving the problems that the titanium-aluminum alloy components prepared through the prior art are uneven in component, rough and large in texture and difficult to prepare and mechanically machine. The component preparation method through the beta-gamma titanium-aluminum alloy prealloy powder spark plasma sintering comprises a first method which comprises raw material preparation, spark plasma sintering and subsequent component processing and a second method which comprises raw material preparation, component fabricated part preparation, spark plasma sintering and subsequent component processing. The component preparation method through the beta-gamma titanium-aluminum alloy prealloy powder spark plasma sintering has the advantages of being low in sintering temperature, short in sintering time, small in prepared alloy grain size, high in density, uniform in component, good in performance, beneficial to later fine finishing, energy saving and environmental friendly. The invention is applicable to prepare the component through the beta-gamma titanium-aluminum alloy prealloy powder spark plasma sintering.

Claims
(CN104550956)
1. beta-gamma TiAl prealloyed spark plasma sintering method of preparing a member, characterized in beta-gamma TiAl prealloyed discharge plasma sintering is completed by the following steps in particular member of a:
A, the raw material preparation: weighing particle diameter of 0.5 m-a 350 m nominal formula Ti-(40-44.5) Al-(0.5-10) X-(0.1-1) Z (at %) of beta-gamma TiAl pre-alloyed powder;
In the step one Ti-(40-44.5) Al-(0.5-10) X-(0.1-1) Z (at %) is in the beta phase stabilizing elements X; Mo of beta phase stabilizing elements, Cr, Nb, V, W, Fe and the one or more mixed Mn; Z of alloying elements; B of alloying elements, and the one or several C Y mixing;
In a nominal formula of step Ti-(40-44.5) Al-(0.5-10) X-(0.1-1) Z (at %) of beta-gamma TiAl pre-alloyed powder is a rotating electrode atomization or inert gas atomization technique of plasma techniques;
Second, spark plasma sintering: step a particle diameter of 0.5 m is weighed-350 m nominal formula Ti-(40-44.5) Al-(0.5-10) X-(0.1-1) Z (at %) of beta-gamma TiAl pre-alloyed powder into the mold, further comprising a beta-gamma TiAl pre-alloyed powder into a mold discharge plasma sintering furnace, to continuously containing beta-gamma TiAl pre-alloyed powder 10 mpa is applied to the mold-axial pressure of 150 mpa, the degree of vacuum of 10-4Pa-10Pa temperature in the furnace under spark plasma sintering temperature rise rate of 20 °C/min-heating rate from room temperature to 950 °C 200 °C/min-1350 °C, 950 °C at a temperature of re-incubated 2min 1350 °C -30min, the furnace power re-closable discharge plasma sintering, the oil was cooled to room temperature, to obtain a discharge plasma sintered beta-gamma TiAl component;
Two step subjected to the spark plasma sintering of beta-gamma TiAl to a density greater than 99% of the component;
Three, subsequent processing member: on the discharge plasma sintered beta-gamma TiAl component processing is finished, to obtain a beta-gamma TiAl component.
2. Beta-gamma TiAl prealloyed spark plasma sintering method of producing the member according to claim 1, characterized in having a particle diameter of 0.5 m is weighed in a step-350 m nominal formula Ti-(41-44) Al-(2-9) X-(0.1-1) Z (at %) of beta-gamma TiAl pre-alloyed powder.
3. Beta-gamma TiAl member of a spark plasma sintering prealloyed powders prepared according to claim 1, characterized in step a particle size of 0.5 m is weighed-350 m nominal formula Ti-(42.5-43.5) Al-(2-9) X-(0.2-0.5) Z (at %) of beta-gamma TiAl pre-alloyed powder.
4. Beta-gamma TiAl spark plasma sintering prealloyed member of a preparation according to claim 1, characterized in that a 0.5 m particle size was weighed in step-a 350 m nominal formula Ti -43Al-9V-0.3Y (at %) of beta-gamma TiAl pre-alloyed powder.
5. Beta-gamma TiAl spark plasma sintering prealloyed member of a preparation according to claim 1, characterized in that in step two TiAl alloy member preform is inserted into the discharge plasma sintering furnace, to continuously applied alloy member preform TiAl 30 mpa-axial pressure of 120 mpa, a vacuum degree of 10-3Pa-5Pa under spark plasma sintering furnace to 20 °C/min-heating rate from room temperature to 950 °C 200 °C/min-1250 °C, 950 °C at a temperature of re-incubated 2min 1250 °C -30min, and then turning off the discharge plasma sintering furnace power cooling to room temperature, to obtain a discharge plasma sintered beta-gamma TiAl component.
6. A beta-gamma TiAl member of a spark plasma sintering prealloyed powders prepared according to claim 1, characterized in that the step two TiAl into the discharge plasma sintering furnace pre-alloy member, for applying TiAl alloy member preform to 40 mpa-axial pressure of 100 mpa, a vacuum degree of 10-3Pa-5Pa spark plasma sintering furnace to 20 °C/min under-heating rate from room temperature to 950 °C 200 °C/min-1250 °C, 950 °C at a temperature of re-incubated 5min 1250 °C -20min, re-closable discharge plasma sintering furnace supply cooled to room temperature, to obtain a discharge plasma sintered beta-gamma TiAl component.
7. beta-gamma TiAl prealloyed spark plasma sintering is controlled by means of the method, characterized in beta-gamma TiAl prealloyed spark plasma sintering is completed by the following steps in particular member of a:
A, the raw material preparation: weighing particle diameter of 0.5 m-a 350 m nominal formula Ti-(40-44.5) Al-(0.5-10) X-(0.1-1) Z (at %) of beta-gamma TiAl pre-alloyed powder;
In the step one Ti-(40-44.5) Al-(0.5-10) X-(0.1-1) Z (at %) is in the beta phase stabilizing elements X; Mo of beta phase stabilizing elements, Cr, Nb, V, W, Fe and the one or more mixed Mn; Z of alloying elements; B of alloying elements, and the one or several C Y mixing;
In a nominal formula of step Ti-(40-44.5) Al-(0.5-10) X-(0.1-1) Z (at %) of beta-gamma TiAl pre-alloyed powder is a rotating electrode atomization or inert gas atomization technique of plasma techniques;
Second, preparing member preform: step a particle diameter of 0.5 m is weighed-350 m nominal formula Ti-(40-44.5) Al-(0.5-10) X -(0.1-1) Z (at %) of beta-gamma TiAl pre-alloyed powder into the mold, at a pressure of 20 mpa-150 mpa, temperature 200 °C -1350 °C, the sintering time is 5min-10 to 480min and vacuum-3Pa-10Pa of compressing, pre-alloy member obtained TiAl;
Three, spark plasma sintering: the plasma discharge to TiAl alloy member preform is inserted into a sintering furnace, to continuously applied alloy member preform TiAl 10 mpa-150 mpa of an axial compression, vacuum degree 10-4Pa-10Pa the spark plasma sintering temperature in the furnace at a heating rate of 20 °C/min-rising rate of 200 °C/min from room temperature to 950 °C -1350 °C, 950 °C at a temperature of re-incubated 2min 1350 °C -30min, re-closable discharge plasma sintering furnace power, the oil was cooled to room temperature, the resulting spark plasma sintering of the beta-gamma TiAl component;
Four, subsequent processing member: a spark plasma sintering of the beta-gamma TiAl component processing is finished, to obtain a beta-gamma TiAl component.
8. A beta-gamma TiAl spark plasma sintering prealloyed member of a preparation according to claim 7, characterized in that a 0.5 m particle size was weighed in step-a 350 m nominal formula Ti-(41-44) Al-(2-9) X-(0.1-1) Z (at %) of beta-gamma TiAl pre-alloyed powder.
9. Beta-gamma TiAl prealloyed spark plasma sintering is controlled by means of the method according to claim 7, characterized in the second step is 40 mpa for the sintering processes-100 mpa, temperature 450 °C -1300 °C, degree of vacuum was 10-3-8Pa, sintering time is 30min-120min.

10. A beta-gamma TiAl member of a spark plasma sintering prealloyed powders prepared according to claim 7, characterized in that in step three the discharge plasma sintering TiAl alloy member placed in the preform, the continuation containing beta-gamma TiAl pre-alloyed powder mold applied 40 mpa-axial pressure of 100 mpa, a vacuum degree of 10-3Pa-5Pa spark plasma sintering furnace to 40 °C/min under-heating rate from room temperature to 950 °C 100 °C/min-1250 °C, 950 °C at a temperature of re-incubated 5min 1250 °C -15min, and then turning off the discharge plasma sintering furnace power source, the oil was cooled to room temperature, to obtain a discharge plasma sintered beta-gamma TiAl component.

High-Nb TiAl alloy with good hot-working performance and preparation method thereof

CN102392171

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- **International Patent Classification**
  B22D-027/04 B22D-027/15 C22C-001/03 C22C-030/00
- **Publication Information**
  CN102392171 A 2012-03-28 [CN102392171]
- **Priority Details**
  2011CN-0391443 2011-11-30

- **Fampat family**

CN102392171	A	2012-03-28	[CN102392171]

- **Abstract:**
  (CN102392171)
  High-Nb TiAl alloy with good hot-working performance and a preparation method thereof relate to high-Nb TiAl alloy and its preparation method. The invention aims to solve the problem of poor deformation capacity existing in present high-Nb TiAl alloy. The high-Nb TiAl alloy with good hot-working performance is prepared by melting Al, Nb, Cr, Y and Ti. The preparation method comprises the following steps of: (1) batching; (2) melting at high temperature; and (3) cast molding to obtain the high-Nb TiAl alloy with good hot-working performance. The advantages are as follows: firstly, beta phase is stabilized, and the thermal deformation capacity and mechanical properties of the high-Nb TiAl alloy are improved; Secondly, solidification path of the high-Nb TiAl alloy is changed, and by beta phase solidification, fine and uniform microstructure with no obvious segregation can be obtained, which is beneficial to the subsequent thermo-mechanical treatment and preparation of sheet materials. The preparation method provided by the invention is mainly used for preparing the high-Nb TiAl alloy.

Claims

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1. A good hot workability of high niobium titanium aluminum alloy, characterized in hot workability of the aluminum alloy with good high-Titanium in atomic percentages by 40%-49% Al, 6%-9% Nb, 4%-7% Cr, 0.03%-0.4% Y and the balance being Ti obtained by melting.

2. Claim 1 of the hot-workability good as Niobium-Titanium aluminum alloy having a high production method, characterized in Niobium-Titanium aluminum alloy having good hot workability of high preparation of completion of the method is as follows:
One, ingredients: in atomic percentages 40%-49% Al, 6%-9% Nb, 4%-7% Cr, 0.03%-0.4% Y and the balance being Ti ratio material; second, smelting: step a proportioning of the at temperatures up to 1500 °C -1700 °C, degree of vacuum is 0.5x10-2MPa -1.5x10-2MPa smelting under conditions of uniform, and at a temperature of 1500 °C -1700 °C, degree of vacuum is 0.5x10-2MPa -1.5x10-2MPa of incubating 8min-30min, to obtain a stable alloy melt; three, cast: first the casting mold at 200 °C -300 °C is preheated for 3h-5h, obtained after preheating the casting die, and then the second step of obtaining a stable alloy melt is cast into a preheated casting mold, a vacuum degree of 0.5x10-2MPa-1.5x10-2MPa was cooled to room temperature, that is obtained with a good hot workability of high-Titanium aluminum alloy; AlNb master alloy material is in the first step, a high-purity Al, Ti sponge, AlY alloys Cr alloy and a high-purity.