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Preparation method of high-niobium TiAl intermetallic compound
CN103469135

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- **Abstract:**
  (CN103469135)
  The invention relates to a preparation method of high-niobium TiAl intermetallic compound. The prepared high-niobium TiAl intermetallic compound can substitute nickel-base superalloy and other materials to be used for manufacturing heat-resisting structure components of advance aircrafts in the aviation and aerospace field, can achieve about 50% lightweight effect, and belongs to the technical field of aviation and aerospace heat-resisting materials. According to the prepared high-niobium TiAl intermetallic compound, the mechanical property sigma b is more than or equal to 800MPa, delta5 is more than or equal to 1.0%; at 1100DEG C, the mechanical property sigma b is more than or equal to 70MPa and delta5 is more than or equal to 8.0%; the internal quality of the high-niobium TiAl intermetallic compound prepared by the technique can reach the A-grade level of GJB1580A; the density of the high-niobium TiAl intermetallic compound prepared by the technique is higher than the theoretical density by 99%.

Claims

(CN103469135)

1. Preparation of TiAl-based intermetallic compound of a high-niobium method, characterized in steps of:
1) high niobium titanium aluminide prealloyed powders will be subjected to ball;
2) Step 1) loaded with a low carbon steel prealloyed powders after milling of the envelope in a high niobium titanium aluminide, and the low carbon steel sheath evacuation;
3) Step 2) of the low-carbon steel envelope to hot isostatic pressing densification treatment, the resulting green compact material;
4) Removing Step 3) a material obtained by a low carbon steel sheath outside the green compact, high-niobium TiAl-based intermetallic compound to obtain a blank;
5) Step 4) the resulting high-niobium TiAl-based intermetallic compound quartz glass blank is placed in the envelope, is subjected to solution treatment, to obtain high-niobium TiAl-based intermetallic compound material, which niobium molar content of not less than 5%.

2. One high-niobium TiAl-based intermetallic compound was prepared according to claim 1, characterized in: step 1) is used in a jar mill for milling titanium alloy, by means of ball-milling the diamond to the high niobium-titanium aluminide prealloyed powders, and the tank was filled with a volume ratio of 8:1 titanium alloy milling a mixed gas of argon and hydrogen.

3. Preparation of TiAl-based intermetallic compound of a high-niobium method according to claim 1, characterized in: step 2) in the low carbon steel sheath of evacuation process to: 2h degassed at room temperature, vacuum degree to be low carbon steel sheath within better than 3x10-3Pa rear, low carbon steel sheath was heated to 260 °C, insulation 3h, vacuum within the envelope to be mild steel is better than 4x10-3Pa rear, low carbon steel sheath was raised to 680 °C, incubation time 12h, finally the low carbon steel sheath over the vacuum within 1x10-3Pa.

4. Preparation of TiAl-based intermetallic compound of a high-niobium method according to claim 1, characterized in: step 3) in the low carbon steel sheath to hot isostatic pressing densification treatment process are: temperature of 1280 °C, a pressure of 150 mpa, time of 4h.

5. Preparation of TiAl-based intermetallic compound of a high-niobium method according to claim 1, characterized in: step 4) processing means of eliminating the low carbon steel sheath in the car.

6. Preparation of TiAl-based intermetallic compound of a high-niobium method according to claim 1, characterized in: step 5) in the solution treatment process is as follows: a quartz glass envelope was filled with argon, a pressure of 5 mpa, and then the quartz glass envelope placed into a furnace for heat treatment, heat treatment temperature is: 1st step, temperature was raised to 1420 °C, the incubation time was 60min, and then oil quenching to room temperature; 2nd step, was heated to 980 °C, temperature holding time is 48h, the last of the oven was allowed to cool.

Forming method of TiAl pipe target material in large length-diameter ratio
CN103071791

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- **Abstract:**

(CN103071791)
The invention relates to a forming method of TiAl pipe target material in a large length-diameter ratio. The forming method comprises the following steps of (1) assembling of a sheath die; (2) packing and sealing welding of raw materials of Ti powder and Al powder; (3) vacuum heat degassing; (4) densification forming of hot isostatic pressure; (5) removing of the sheath die; and (6) product fine processing. According to the forming method disclosed by the invention, the structure of the sheath die is subjected to innovation design, excellent welding performance of the sheath die is ensured, the whole binding of the TiAl target material and a back pipe is realized, and segregation-free Ti and Al mixed powder which is uniform in composition is prepared through the optimization selection of raw material powder size and the vacuum material mixing; the powder packing density and the uniformity of the pipe target material are ensured by adopting a special powder packing technology; and the density and the straightness of the TiAl pipe target material after pressing forming can be ensured through optimized technological selection of the vacuum heat degassing and the densification forming.

Claims

(CN103071791)

1. A large aspect ratio TiAl tube target forming method, characterized in: comprising the steps of:
Step (A), assembling the sheath mold: sheath mold comprises an inner sleeve (1), outer sheath (2), the capsule bottom cap (3), the envelope upper cap (4), the tracheal tube (5) and the back pipe (6); first the inner sleeve (1) placed in the outer sheath (2) inside, the envelope bottom cap (3) and the inner sleeve (1), outer sheath (2) welding, the inner sleeve is achieved (1) and the outer sheath (2) positioning, and then the back pipe (6) is fitted over the inner sleeve (1) an outer surface, the final outer sheath (2) punching out, welding the tracheal tube (5);
Step (di), Ti powder and Al powder will be mixed, while loaded in the step (A) assembled by encapsulation of the mold, and covered with the sheath cover (4) is carried out after heat sealing, hermetically sealing the envelope of the mold realized, wherein Ti powder particle size of 100-200 mesh, Al powder particle size of 325 mesh or less;
Step (three), and the sheath mold is placed in heat treatment furnace is heated, and vacuum degassing, the degassing temperature is 300 °C -400 °C, ensure that the vacuum within the envelope of a mold after being degassed greater than 10-3Pa;
Step (four), and the sheath mold is placed in hot isostatic pressing furnace for densification treatment;
Step (five), the densification of the inner sleeve mold removal capsule to be processed (1) and the outer sheath (2), and machined to obtain the desired size with a back (6) integrally formed of a TiAl target tube.
2. A large aspect ratio TiAl target tube forming method according to claim 1, characterized in: step (di) Ti powder and Al powder were mixed in the rear, while loaded in the assembled mold by encapsulation of the specific steps are as follows:
(1), the packet pair of molds positioned horizontally, Ti powder and Al powder and the mixture uniform loading shovel to the capsule bottom mold is used, then the sheath mold positioned vertically erected, drawn off of the loading shovel, 1st-order powder -loading is completed;
(2), after which the envelope 90 degrees rotating mold, causing the sheath mold positioned horizontally, repeating steps (1), 2nd-order powder filling is completed, and so on, co-completion of the four loading;
(3), the packet pair of molds vertically erected, powder was compacted in the mold set of the packet, 1st wheel powder-loading is completed;
(4), repeating steps (1)-(3), completion of the 2nd wheel powder-loading, and so forth, up to a filling a full wrap die.
3. A large aspect ratio TiAl target tube forming method according to claim 1, characterized in: step (di) is carried out in the upper cover sheath (4) welding, each welded 20-30 mm weld bead stop, cooling sheath mold, is carried out after welding, since welding to prevent heat generated by the reaction occurring due to powder.
4. A large aspect ratio TiAl target tube forming method according to claim 1, characterized in: step (four) in the mold in a hot isostatic pressing furnace for envelope densifaction process parameters are: temperature 480 °C -550 °C, pressure 100-110 mpa, holding time 2-5h.
5. A large aspect ratio TiAl tube target forming method according to claim 1, characterized in: back tube (6) is made of stainless steel, titanium or carbon steel pipes.
6. A large aspect ratio TiAl target tube forming method according to claim 1, characterized in: back tube (6) is shorter than the inner sleeve (1), outer sheath (2) has a length, a length difference is 60-80 mm.
7. A large aspect ratio TiAl target tube forming method according to claim 1, characterized in: the inner sleeve (1), outer sheath (2), the capsule bottom cap (3), the envelope upper cap (4) and air duct (5) are made of aluminum.
8. A large aspect ratio TiAl tube target forming method according to claim 1, characterized in: step (di) Ti powder and Al powder were mixed in the mixed powder is granulated after a lapse of a vacuum, so that the powder during the loading process has a higher compaction density and a uniform distribution.

Titanium alloy TC4 TiAl-based intermetallic compound with a high-niobium method of preparing composite member

CN105385869

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CN105385869	A	2016-03-09	[CN105385869]

- **Abstract:**
  (CN105385869)
  Questel Machine translated AbstractThe present invention relates to a high-niobium titanium alloy TC4 TiAl-based intermetallic compound and a method for producing a composite member, by employing a toner-fixing total installed, pre-processing technique TC4 titanium alloy powder, a titanium alloy TC4 TiAl-based intermetallic compound with a high-niobium hot isostatic pressing process such as diffusion bonding method, it is possible to realize high-niobium titanium alloy TC4 TiAl-based intermetallic compound with the welded portion of any complex shape type is connected to an efficient and reliable welded under the bottom surface, preparing a TiAl-based intermetallic compound the titanium alloy TC4 to high-niobium composite member can be stably and reliably with a weld, the weld area dense, and the non-micro-cracks, high coefficient of joint strength.

Claims

(CN105385869)

1. High-niobium titanium alloy TC4 TiAl-based intermetallic compound and a method for producing composite member, characterized in: comprising the steps of:

, (1) High-niobium TiAl-based intermetallic compound will be worked into a desired shape, after which the high-niobium titanium alloy TC4 TiAl-based intermetallic compound block and loaded into identical pre-alloyed powder in the one envelope, and the evacuation sheath at a certain temperature, satisfy the requirements of vacuum in the envelope so closed after the envelope;

, (2) The capsule is placed in hot isostatic pressing apparatus, through pre-pressurization and temperature increase;

, (3) A hot isostatic pressing apparatus of the capsule was heated to the required temperature, the hot isostatic pressing diffusion welding connection;

, (4) The envelope of the oven was cooled to room temperature to, removal of the sheath, the resulting titanium alloy TC4 TiAl-based intermetallic compound with a high-niobium composite member blank, and if necessary to the composite member blank is machined.

2. TiAl-based intermetallic compound with a titanium alloy TC4 high-niobium composite member method for producing according to claim 1, characterized in: TiAl-based intermetallic compound with a titanium alloy TC4 high-niobium is connected can be pre-designed to be soldered part profile shape profile, include them.

3. High-niobium titanium alloy TC4 TiAl-based intermetallic compound and a method for producing composite member according to claim 1, characterized in: high-niobium-based intermetallic compound TiAl step (1) will be processed into a desired shape after, high-niobium TiAl-based intermetallic compound can be in the titanium alloy TC4 to be soldered part connected with the member adding metal intermediate layer, intermediate layer metal is: pure Ni, Ti--15 cu or Ti3 Al-based alloy.

4. TiAl-based intermetallic compound with a titanium alloy TC4 high-niobium composite member production process according to claim 3, characterized in: using a plating, ion plating or arc deposition of metal is attached on the intermediate layer TiAl method high-niobium-based intermetallic compound on a surface thereof to be welded member.

5. TiAl-based intermetallic compound with a titanium alloy TC4 high-niobium composite member production process according to claim 1, characterized in: step (1) of evacuation sheath to a concrete method is: 1h evacuation times at room temperature, degree of vacuum in the envelope to be better than 2x10-3 Parear, 250-300 °C was heated to set the packet, incubated for 2-3h; vacuum inside the envelope to be better than 4x10-3 Parear, 600-800 °C will be raised to the capsule, a temperature holding time 6h, vacuum within the envelope to be better than 3x10-3 Paclosed after the envelope.

6. High-niobium titanium alloy TC4 TiAl-based intermetallic compound with the preparation of composite member method according to claim 1, characterized in: parent material employed for the welding step the (1) high-niobium TiAl-based intermetallic compound of higher melting point of a welding-type surface serving as holding blocks, state may be as-cast, forged state or powder metallurgical transition compound; titanium alloy TC4 having a melting point lower spherical pre-alloyed powder, the powder particle size d 180um to claim as macaroni.

7. High-niobium titanium alloy TC4 TiAl-based intermetallic compound with the preparation of composite member method according to claim 1, characterized in: step (2) of preprocessing for specific process method: the package sleeves into the hot isostatic pressing apparatus, first of all pressurized to the pressure in the capsule to 37-45 mpa, the temperature was raised to 650 -820 °C, incubated for 1-2h.

8. High-niobium titanium alloy TC4 TiAl-based intermetallic compound and a method for producing composite member according to claim 1, characterized in: step (3) to hot isostatic pressing diffusion welding method to connect to a particular process: first increasing the temperature within 900-950 °C temperature of the capsule, retained for 3-4h, pressure is controlled in the range of 130-150 mpa, after incubation, the oven was cooled to room temperature.

9. TiAl-based intermetallic compound with a titanium alloy TC4 high-niobium composite member production process according to claim 1, characterized in: the sheath is made of low carbon steel, stainless steel or pure titanium material.

Preparation method of high performance powder metallurgy high-niobium TiAl line intermetallic compound

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- **Fampat family**

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- **Abstract:**
  (CN104498748)
  The invention relates to a preparation method of a high performance powder metallurgy high-niobium TiAl line intermetallic compound, which comprises the following steps: 1)refining powder granularity through ball milling and increasing surface activity, 2)placing the powder after ball milling in a jacket, and vacuumizing, 3)performing hot isostatic pressure densification processing on the vacuumized jacket, 4)removing the jacket of low carbon steel, and 5)placing the obtained high-niobium TiAl line intermetallic compound blank in a quartz glass jacket for solid solution-aging treatment to obtain the high-niobium TiAl line intermetallic compound material. The prealloyed powder of the high-niobium TiAl line intermetallic compound can be processed by the ball milling method, powder granularity can be refined, powder surface activity can be increased; through optimized vacuum-pumping technology, under condition of guarantee of low hydrogen increase and oxygen increase, good vacuum degree in the jacket can be kept; and the optimized solid solution-aging treatment is used for ensuring the high-niobium TiAl line intermetallic compound to have fine and uniform tissues.

Claims

(CN104498748)

1. A high performance powder metallurgy production method of niobium TiAl based intermetallic compound, characterized in: comprising the steps of:

Step (a), the niobium-based intermetallic compound powder and diamond TiAl ball milling a titanium alloy into an alloy supplying tank, and filled with argon and hydrogen gas mixture, by milling 48-72 h at room temperature;

Step (second), the milling of the powder after loaded with the packet in the set, and the set temperature for a vacuum envelope;

Step (tris), the capsule is subjected to hot isostatic pressing densification after evacuating the processing, to conditions: temperature 1250-1300 °C, 3-4 h incubation period, 130 MPa pressure;

Step (four), removing the sheath;

Step (five), the resulting niobium TiAl based intermetallic compound blank placed in quartz glass envelope, for solution, there is obtained a niobium TiAl intermetallic compound material, wherein the solution treatment specific method is:

A quartz glass envelope filled with argon or helium, 5-10 MPa pressure, and then placed into a furnace envelope quartz glass by heat treatment, heat treatment regime is: 1320-1400 °C temperature, incubation 45-60 min, cooled to room temperature, heated again to 950-1000 °C, insulation 48-60 h, with the furnace after cooling.

2. A high performance powder metallurgy based intermetallic niobium TiAl preparation of a compound according to claim 1, characterized in: step (a) charging 8 volume ratio of argon and hydrogen: 1-10: 1.

3. A niobium powder metallurgy based intermetallic compound TiAl high performance preparation method according to claim 1, characterized in: step (a) the sheath is low carbon steel sheath or titanium alloy in the envelope.

4. A niobium powder metallurgy high performance TiAl intermetallic compound production method according to claim 1, characterized in: step (a) the envelope is evacuated conditions: 1h degassing time at room temperature, then heated to the envelope 250-300 °C, insulation 2-3 h, vacuum degree value is less than within the envelope to be 4x10-3Pa after, to envelope the 600-700 °C temperature, incubation time 6h, vacuum power value within the envelope to be less than 3x10-3Pa after the closed envelope.

5. A high performance powder metallurgy based intermetallic niobium TiAl preparation of a compound according to claim 1, characterized in: step (five) is heat-treated during cooling or air cooling system for cooling oil quenching.

Method for forming Ti3Al-based alloy thin-wall barrel
CN102000944

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- **Fampat family**

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CN102000944	B	2012-01-25	[CN102000944B]

- **Abstract:**
  (CN102000944)
  The invention provides a method for forming a Ti3Al-based alloy thin-wall barrel. The method comprises the following steps of: (1) preparing a barrel blank by using a Ti3Al-based alloy plate with the thickness of between 1.5 and 4 millimeters at the temperature of between 650 and 700 DEG C by a hot rolling and bending method; (2) penetrating and welding a weld in the bus direction of the barrel blank by continuously inputting laser through CO2 so as to obtain a thin-wall barrel; (3) preserving the heat of the thin-wall barrel at the temperature of between 950 and 1,000 DEG C for 1 to 3 hours and cooling the thin-wall barrel along with a furnace; (4) calibrating the thin-wall barrel at the temperature of between 600 and 650 DEG C; and (5) preserving the heat of the thin-wall barrel at the temperature of between 900 and 1,000 DEG C in vacuum for 1 to 2 hours and cooling in the air. Due to the adoption of the method, cracks are effectively prevented in a forming process and deformation resistance is reduced; particularly, the intensity of the weld and a parent metal is lowered by thermal treatment after welding, plasticity is enhanced, and calibration after welding is facilitated andcan be performed at a relatively low temperature; simultaneously, the intensity of the barrel is enhanced integrally through final thermal treatment.

Claims

(CN102000944)

1 . One Ti3Al-based alloy thin wall cylinder which molding method, characterized in: the method comprises the following steps:

(1) to 1.5-4 mm thick Ti3Al based alloy plate materials at 650 °C -700 °C under a temperature condition, is formed by a thermal roll -bending method barrel blanks ;

(2) using CO2 input laser penetration welding step either continuously (1) the resulting weld bead barrel blanks generatrix direction, to give Ti3Al-based alloy thin wall cylinder which, wherein a laser power of 2000W-2500W, scanning speed of 150 cm/min-190 cm/min, focusing surface ;

(3) to step (2) post-welding the resulting Ti3Al-based alloy thin wall cylinder which at 950 °C -1000 °C insulation 1-3h followed by furnace cooling ;

(4) to step (3) heat-treated Ti3Al-based alloy thin wall cylinder which at 600 °C -650 °C for rectifying ;

(5) to step (4) after sizing Ti3Al-based alloy thin wall cylinder which at 900-1000 °C, incubation time under vacuum conditions 1-2 hours later, the air cooling .

2 . One Ti3Al based alloy-based alloy thin wall cylinder which forming method according to claim 1, characterized in: this Ti3Al-based alloy thin wall cylinder which comprises the following steps forming method:

(1) to 3 mm thick Ti3Al based alloy plate materials at a temperature of 700 °C, barrel blanks formed by a thermal roll-bending process ;

(2) using CO2 input laser penetration welding step either continuously (1) the resulting weld bead barrel blanks generatrix direction, to give Ti3Al-based alloy thin wall cylinder which, wherein a laser power of 2500W, scanning speed of 190 cm/min, focusing surface ;

(3) to step (2) after laser welding the resulting Ti3Al based alloy followed by furnace cooling 1.5h incubation in a thin wall cylinder which 950 °C ;

(4) to step (3) heat-treated Ti3Al at isothermal conditions based alloy thin wall cylinder which shape the 600 °C ;

(5) to step (4) after sizing Ti3Al-based alloy thin wall cylinder which at 980 °C, heat treatment is performed under vacuum conditions, after 1.5 hours incubation time, air cooling.