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The TiAl fund intergeneric chemical compound alloy and its production method of possessing high intensity

JP05186842

<ul style="list-style-type: none"> • Patent Assignee SHINNIPPON SEITETSU • Inventor MASAHASHI NAOYA MIZUHARA YOJI • International Patent Classification C22C-014/00 C22F-001/00 C22F-001/18 	<ul style="list-style-type: none"> • Publication Information JPH05186842 A 1993-07-27 [JP05186842]     • Priority Details 1991JP-0165404 1991-07-05 1992JP-0177158 1992-07-03 								
<ul style="list-style-type: none"> • Fampat family <table style="width: 100%; border: none;"> <tr> <td style="width: 30%;">JPH05186842</td> <td style="width: 15%;">A</td> <td style="width: 25%;">1993-07-27</td> <td style="width: 30%;">[JP05186842]</td> </tr> <tr> <td>JP2729011</td> <td>B2</td> <td>1998-03-18</td> <td>[JP2729011]</td> </tr> </table> 		JPH05186842	A	1993-07-27	[JP05186842]	JP2729011	B2	1998-03-18	[JP2729011]
JPH05186842	A	1993-07-27	[JP05186842]						
JP2729011	B2	1998-03-18	[JP2729011]						

- **Abstract:**

(JP05186842)

PURPOSE: To provide a TiAl-based intermetallic compound alloy having high specific strength and heat resistance by exerting forming by using a beta+gamma TiAl- based intermetallic compound having grain boundaries consisting of beta-phase by means of superplastic working.

CONSTITUTION: Forming is carried out by using a beta+gamma TiAl-based intermetallic compound, which has grain boundaries composed of beta-phase and also has superplastic deformability, by means of superplastic working, by which a high strength TiAl-based intermetallic compound alloy consisting of an (alpha2+gamma) dual phase structure having a strength of ≥ 400 MPa from room temp. to 1073K can be constituted. The volume percentage of the alpha2 phase is regulated to 5-40%. As the third additive element, Cr is incorporated into the TiAl-based intermetallic compound. Further, \geq at least one kind among Nb, Mo, Hf, Ta, W, and V is incorporated. By this method, a formed product of the TiAl-based intermetallic compound having high strength can be provided.

Claims

(JP05186842)

Claims machine translated from Japanese

1. The grain boundary is I phase and it possesses super plastic deformability

From .beta.+ .gamma. TiAl fund intergeneric chemical compound with super deformation processing adding

Manufacture it formed, from room temperature to 1073K above 400MPa

It possesses strength, I [2] + .gamma. it possesses high intensity it consists of quarter-phase organization

[ru] TiAl fund intergeneric chemical compound alloy.

2. I [2] cubic measure amount ratio of phase 40% or less of 5% or more

So I of the claim 1 statement which features that it is [2] + .gamma. quarter-phase group

Woven alloy.

3. TiAl fund intergeneric chemical compound, in TiAl

Cr is included as a third additional element, with lower system of ternary type inscription

The claim which possesses high intensity it features that it is [re] ru constitution

TiAl fund intergeneric chemical compound alloy of 1 statements.

Ti [a] Al [100-a-b] Cr [b]

However $1 \leq b \leq 5$ 47. $5 \leq a \leq 52$ 2. $A + b \geq 100$

4. TiAl fund intergeneric chemical compound, in TiAl

In the ternary system which includes Cr as a additional element, furthermore Nb, M

o, Hf, Ta and W, among V at least above kind from here

Below consisting of the pluralistic system which adds in atomic amount ratio under it is inscribed with formula,

The claim 1 which possesses high intensity it features that it is [ru] constitution

TiAl fund intergeneric chemical compound alloy of statement.

Ti [a] Al [100-a-b-c] Cr [b] X [c]

X: Nb, Mo, Hf, Ta and W, V

However $47.5 \leq a \leq 52$ 1. $\leq b \leq 5$ 0. $5 \leq c \leq 3$ $b \geq c$ 2. $A + b + c \geq 100$

5. As a TiAl fund intergeneric chemical compound, the addition origin

In the ternary system which includes Cr as an element, furthermore inside one Si and B

It consists of the pluralistic system which from kind adds two kinds in atomic amount ratio below

-under system with inscribe do constitute be being thing feature with do high strength

TiAl fund intergeneric chemical compound formation combination of the claim 1 statement which it possesses

Gold.

Ti [a] Al [100-a-b-d] Cr [b] Y [d]

Y: Si and B

However $47.5 \leq a \leq 52$ 1. $\leq b \leq 5$ 0. $1 \leq d \leq 2$ 2. $A + b + d \geq 100$

6. TiAl fund intergeneric chemical compound, in TiAl

In the ternary system which includes Cr as a additional element, furthermore Nb, M

o, Hf, Ta and W, among V at least above kind,

And from the inside kind of Si and B two kinds in atomic amount ratio below

Below consisting of the pluralistic system which adds it is the constitution which is inscribed with formula, it is dense

That TiAl of the claim 1 statement which possesses high intensity it features

Fund intergeneric chemical compound alloy.

Ti [a] Al [100-a-b-c-d] Cr [b] X [c] Y [d]

X: Nb, Mo, Hf, Ta and W, V

Y: Si and B

However $47.5 \leq a \leq 52$ 1. $\leq b \leq 5$ 0. $5 \leq c \leq 3$ $b \geq c$ 0. $1 \leq d \leq 2$ 2. $A + b + c + d \geq 100$

7. TiAl fund intergeneric chemical compound *** make after, high temperature

.beta.+ which possesses the super plastic deformability which administers processing, includes grain boundary I phase

To make the I quarter-phase alloy, with super deformation processing next in the product compact

To to process, furthermore with metamorphosis heat treatment from room temperature 107

It possesses the strength above 400MPa to 3K, I [2] + .gamma. quarter-phase group

The TiAl fund which possesses high intensity the processed formation item of weaving is produced
Consistent production method of intergeneric chemical compound formation item.

8. Hot working, non oxidation characteristic atmosphere or 5x

10 (- 3) under a higher vacuum atmosphere than Torr, solid phase above 1173K

At temperature below line temperature, initial strain speed 5x10 (- 1) below,

To administer the hot working of processed ratio 60% or more, next 10K/min

Rather than at fast cooling rate descending/disembarking warm to do to lowest 873K, the metamorphosis thermal place

Reason non oxidation characteristic atmosphere or 5x10 (- 5) Torr compared to high truth sky

Being similar, below solidus temperature above 1123K, the thermal place of 2 hours or more

Ti of the claim 7 statement which possesses high intensity it is the method of doing reason

Consistent production method of Al fund intergeneric chemical compound formation item.

9. Hot working, non oxidation atmosphere or 5x1

0 (- 5) under a higher vacuum atmosphere than Torr, solidus above 1123K

At temperature below temperature, initial strain speed 5x10 (- 1) below, adding

To administer the hot working of power 60% or more, next 10K/min

[ri] at fast cooling rate to lowest 873K after the descending/disembarking warm, metamorphosis heat treatment

Continuing inside the processed device, below solidus temperature above 1123K

Being similar, less than 2 hours or more 24 hours to keep, from 10K/min

At fast cooling rate, the method descending/disembarking warm of doing at least to 873K

So TiAl fund intergeneric of the claim 7 statement which is superior to high intensity it is

Consistent production method of chemical compound formation item.

10. Hot working with constant temperature forging, sample Ti combination

To insert in the gold capsule, inside the capsule the 5x10 (- 3) Torr

Also the [ri] in the high vacuum after the deaerating, closes airtight with electron beam welding

It is the method of doing, in the atmosphere doing constant temperature forging, to high intensity superior

The [re] it is consistency production of the TiAl fund intergeneric chemical compound of claim 7 statement

Method.

11. Constant temperature forging, sample Ti alloy capsule

So being overturned, with the method of inserting, in the atmosphere doing constant temperature forging a

TiAl fund intergeneric of the claim 10 statement which is superior in the [ru] and high intensity

Consistent production method of chemical compound.

12. Hot working with rolling, sample Ti alloy

To insert in [su], inside the case the 5x10 (- 3) Torr compared to high the truth

-sky with deaerate behind, electron beam weld with close airtight do, roll

In the atmosphere it is the method of doing, the claim 7 description which is superior to high intensity

Consistent production method of TiAl fund intergeneric chemical compound of *** .

13. As rolling, the sample with the Ti alloy the sheath

It did, it is the method of rolling in the atmosphere, it was superior to high intensity

TiAl fund intergeneric chemical compound of claim 12 statement consistent production

Law.

14. Hot working with high-temperature extrusion, sample T

-i alloy case with insertion do, case inside 5x10 (- 3) Torr

Also the [ri] in the high vacuum after the deaerating, closes airtight with electron beam welding

It is the method of doing, in the atmosphere doing the high-temperature extrusion, high intensity

Consistency of the TiAl fund intergeneric chemical compound of the claim 7 statement which is superior

Production method.


15. As a high-temperature extrusion, the sample the Ti alloy

With the method of inserting in the case, in the atmosphere doing the high-temperature extrusion

TiAl fund being attached of the claim 14 statement which is superior to a certain and high intensity

Consistent production method of between chemical compound.

**.gamma. and .beta. dual phase TiAl based intermetallic compound alloy having
superplasticity
JP05070873**

<ul style="list-style-type: none"> • Patent Assignee NIPPON STEEL SHINNIPPON SEITETSU • Inventor MATSUO MUNETSUGU MASAHASHI NAOYA HASHIMOTO KEIZO HANAMURA TOSHIHIRO FUJII HIDEKI KIMURA MASAO MIZUHARA YOUJI SUZUKI HIROO • International Patent Classification C22C-014/00 C22F-001/00 C22F-001/18 • US Patent Classification PCLO=420421000 PCLO=420421000 PCLX=148421000 PCLX=148671000 PCLX=420417000 PCLX=420419000 • CPC Code C22C-014/00 	<ul style="list-style-type: none"> • Publication Information JPH0570873 A 1993-03-23 [JP05070873]  <ul style="list-style-type: none"> • Priority Details 1991JP-0098322 1991-01-31 1991US-07742846 1991-08-08 1993US-08026707 1993-03-05 																
<ul style="list-style-type: none"> • Fampat family <table style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td style="padding: 2px;">JPH0570873</td> <td style="padding: 2px;">A</td> <td style="padding: 2px;">1993-03-23</td> <td style="padding: 2px;">[JP05070873]</td> </tr> <tr> <td style="padding: 2px;">US5232661</td> <td style="padding: 2px;">A</td> <td style="padding: 2px;">1993-08-03</td> <td style="padding: 2px;">[US5232661]</td> </tr> <tr> <td style="padding: 2px;">US5348702</td> <td style="padding: 2px;">A</td> <td style="padding: 2px;">1994-09-20</td> <td style="padding: 2px;">[US5348702]</td> </tr> <tr> <td style="padding: 2px;">JP2546551</td> <td style="padding: 2px;">B2</td> <td style="padding: 2px;">1996-10-23</td> <td style="padding: 2px;">[JP2546551]</td> </tr> </tbody> </table> 		JPH0570873	A	1993-03-23	[JP05070873]	US5232661	A	1993-08-03	[US5232661]	US5348702	A	1994-09-20	[US5348702]	JP2546551	B2	1996-10-23	[JP2546551]
JPH0570873	A	1993-03-23	[JP05070873]														
US5232661	A	1993-08-03	[US5232661]														
US5348702	A	1994-09-20	[US5348702]														
JP2546551	B2	1996-10-23	[JP2546551]														

- **Abstract:**

(US5232661)

This invention relates to TiAl based intermetallic compound alloy and process for producing; the object of this invention is to improve high temperature deformability. The alloy comprises basic components: $Ti_y Al_{1-x}$, wherein $1\% \leq x \leq 5\%$, $47.5\% \leq y \leq 52\%$, and $x + 2y \geq 100\%$, and comprises a fine-grain structure with a BETA phase precipitated on a grain boundary of equiaxed GAMMA grain having grain size of less than 30 μm , and possessing a superplasticity such that the strain rate sensitivity factors (m value) is 0.40 or more and tensile elongation is 400% or more tested at 1200 (degree) C. and a strain rate of 5×10^{-4} S⁻¹.

Claims

(US5232661)

We claim:





1. GAMMA and BETA dual phase TiAl based intermetallic compound alloy having superplasticity, which consists essentially of basic compositions in the atomic rate:

wherein

and consists essentially of fine-grain structure with BETA phase precipitated on the grain boundary of an equiaxed GAMMA grain having a grain size less than 30 MU m having been isothermally forged at a temperature of greater than 1100 (degree) C.

2. The intermetallic compound according to claim 1, wherein the grain size of the GAMMA -grain is less than 18 MU m.

Production method of SiC fiber-reinforced TiAl composite material JP09041053

<ul style="list-style-type: none"> • Patent Assignee KAWASAKI HEAVY INDUSTRIES SHINNIPPON SEITETSU • Inventor IMUDA MAMORU NAKATANI HIROSHI SHIMADA YUKIO MIZUHARA YOJI HASHIMOTO KEIZO • International Patent Classification C22C-047/20 	<ul style="list-style-type: none"> • Publication Information JPH0941053 A 1997-02-10 [JP09041053] <li style="text-align: right;">    • Priority Details 1995JP-0209991 1995-07-26 								
<ul style="list-style-type: none"> • Fampat family <table style="width: 100%; border: none;"> <tr> <td style="width: 30%;">JPH0941053</td> <td style="width: 20%;">A</td> <td style="width: 20%;">1997-02-10</td> <td style="width: 30%;">[JP09041053]</td> </tr> <tr> <td>JP2784161</td> <td>B2</td> <td>1998-08-06</td> <td>[JP2784161]</td> </tr> </table> 		JPH0941053	A	1997-02-10	[JP09041053]	JP2784161	B2	1998-08-06	[JP2784161]
JPH0941053	A	1997-02-10	[JP09041053]						
JP2784161	B2	1998-08-06	[JP2784161]						

- **Abstract:**

(JP09041053)

PROBLEM TO BE SOLVED: To provide a method for producing an SiC fiber reinforced Ti-Al composite material by which deterioration in the characteristics of SiC fibers caused by excessive boundary reaction can be suppressed without need of a material other than a fiber and matrix, and furthermore, the generation of matrix cracks caused by the mismatch of the coefficient of thermal expansion(CTE) can be suppressed. SOLUTION: In a state in which SiC fiber layers are interposed between Ti-Al base alloy foils having superplastic characteristics (SPF characteristics), and their lamination is numerously executed. The Ti-Al base alloy foils are subjected to plastic deformation under the temp. conditions of 900 to 1,100 deg.C in a vacuum under pressure to bury the gaps among fibers in the SiC fiber layers. Moreover, the Ti-Al base alloy foils are diffusedly joined with each other and are compounded to produce the SiC fiber reinforced Ti-Al composite material.

Claims

(JP09041053)

Claims machine translated from Japanese

1. The TiAl basic alloy foil which possesses super plastic quality

Putting SiC fiber layer between, large number to laminate, the 900-110

Under temperature conditions of 0.deg.C, at truth sky and under pressurizing the aforementioned TiAl basis

Plasticity making the alloy foil deform, the opening between the fibers of SiC fiber layer

It buries, at the same time it spreads connects the TiAl basic alloy foil and compounds

The SiC fiber-reinforced TiAl compound material which features that it converts

Production method of charge.

2. SiC fiber reinforcement TiAl of claim 1 statement


At the time of the production method of the composite material, condition under pressurizing, 500

kgf/cm (2) being something which pressure above predetermined time is spent

The SiC fiber-reinforced TiAl composite material which is made feature production

Law.

Production of tial-based multiple intermetallic compound JP05070860

<ul style="list-style-type: none"> • Patent Assignee SHINNIPPON SEITETSU • Inventor NAGUMO MICHIIHIKO SUZUKI TATSU INO TOORU • International Patent Classification B22F-001/00 C22C-001/00 C22C-001/04 C22C-001/05 C22F-001/00 C22F-001/18 	<ul style="list-style-type: none"> • Publication Information JPH0570860 A 1993-03-23 [JP05070860] <div style="text-align: right; margin-top: 5px;">  </div> <ul style="list-style-type: none"> • Priority Details 1991JP-0258709 1991-09-11 								
<ul style="list-style-type: none"> • Fampat family <table style="width: 100%; border: none;"> <tr> <td style="width: 30%;">JPH0570860</td> <td style="width: 10%; text-align: center;">A</td> <td style="width: 20%;">1993-03-23</td> <td style="width: 30%;">[JP05070860]</td> </tr> <tr> <td>JP2877999</td> <td style="text-align: center;">B2</td> <td>1999-04-05</td> <td>[JP2877999]</td> </tr> </table> 		JPH0570860	A	1993-03-23	[JP05070860]	JP2877999	B2	1999-04-05	[JP2877999]
JPH0570860	A	1993-03-23	[JP05070860]						
JP2877999	B2	1999-04-05	[JP2877999]						

- **Abstract:**

(JP05070860)

PURPOSE: To produce an intermetallic compd. to be used as the heat and wear- resistant materials wherein a carbide and a titanium-aluminum-based intermetallic compd. are finely compounded. CONSTITUTION: The metal powders of titanium and aluminum are mechanically alloyed in an inert gas atmosphere to form the cohesive aggregates, then a lower hydrocarbon is added to the aggregates which are mechanically alloyed in a wet state, hence the metal powders react with the hydrocarbon, the excess hydrocarbon is removed from the product, and the product is pressed and sintered to produce a TiAl-based intermetallic compd. wherein the carbides are compounded. Consequently, the carbides and the titanium-aluminum-based intermetallic compd. are finely compounded, and the hardness is remarkably enhanced from the room temp. to high temp. COPYRIGHT: (C)1993,JPO&Japio

Claims

(JP05070860)

1. Metal powder of titanium and aluminum

To do [mekanikaruoiingu] in inert gas atmosphere, the denseness

After making the cohesion body form which sticks, including the low-grade hydrocarbon moisture

Doing [mekanikaruoiingu] in type state, the metal powder and low grade

To react with the hydrocarbon, furthermore from this product the excessive charcoal


After removing conversion hydrogen, it carbonizes by pressurizing & sinter

The TiAl fund intergeneric chemical combination which features that the thing is made to compound

Production method of thing.

Intermetallic TiAl-Fe basic alloy

JP03197632

<ul style="list-style-type: none"> • Patent Assignee SHINNIPPON SEITETSU • Inventor MASAHASHI NAOYA MATSUO SOJI • International Patent Classification C22C-014/00 	<ul style="list-style-type: none"> • Publication Information JPH03197632 A 1991-08-29 [JP03197632]  <ul style="list-style-type: none"> • Priority Details 1989JP-0335795 1989-12-25 								
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JPH03197632	A	1991-08-29	[JP03197632]						
JP2735331	B2	1998-04-02	[JP2735331]						

- **Abstract:**

(JP2735331)

PURPOSE: To improve the compressive deformation properties of the alloy and to permit the regulation of its structure by specifying the ratios of Ti, Al and Fe by atomic fractions.

CONSTITUTION: The compsn. of an intermetallic compound TiAl-Fe base alloy is formed of a formula $Ti_{(sub\ x)}Al_{(sub\ 1-x-y-z)}Fe_{(sub\ y)}$; where, by atomic fraction, $0.50 < x < 0.52$, $0.005 < y < 0.04$ and $0.505 < x+y < 0.55$ are satisfied. Its compressive properties are improved only when Fe atoms are blended so as to be substituted with Al atoms each other. Furthermore, the solid soln. strengthening owing to the addition of Fe is also permitted. In this way, its application to the process of working such as rolling and forging in which compressive stress is influential is made advantageous. COPYRIGHT: (C)1991,JPO&Japio

Claims

(JP2735331)

Claims machine translated from Japanese

1. To consist of titanium, the aluminum and the iron?

The aforementioned element the atomic amount ratio component it is indicated by the below-mentioned formula densely


That the intermetallic TiAl which is superior in the compressed deformation quality which is featured

- Fe basic alloy.

Ti [x] Al [1-x-y] Fe [y] however $0.50 \leq x \leq 0.52$. $0.005 \leq y \leq 0.04$. $0.505 \leq x+y \leq 0.55$

Continuous thin sheet of titanium-aluminium intermetallic compound and process for producing same

CA2011219

<ul style="list-style-type: none"> • Patent Assignee NIPPON STEEL SHINNIPPON SEITETSU • Inventor MIZOGUCHI, TOSHIAKI MIYAZAWA, KENICHI HANAMURA, TOSHIHIRO MASAHASHI, NAOYA • International Patent Classification B22D-011/06 C22C-001/02 C22C-014/00 • US Patent Classification PCLO=428660000 PCLO=164475000 PCLX=148403000 PCLX=148407000 PCLX=420418000 • CPC Code B22D-011/06; C22C-014/00; Y10T-428/12806 	<ul style="list-style-type: none"> • Publication Information CA2011219 A1 1990-09-02 [CA2011219] <div style="text-align: right; margin-top: 5px;">  </div> <ul style="list-style-type: none"> • Priority Details 1989JP-0050649 1989-03-02 1990JP-0050307 1990-03-01 																																								
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JP2958792	B2	1999-10-06	[JP2958792]																																						

- **Abstract:**

(EP-389821)

A continuous thin sheet of a TiAl intermetallic compound consisting of from 35 to 44 wt% Al and the balance Ti and unavoidable impurities, having a thickness of from 0.2 to 3 mm, and having a solidified, as-cast structure comprising columnar crystals extending from both surfaces of the sheet toward the center of the sheet thickness, and a process for producing the same by using a twin-roll type continuous casting procedure.

Claims

(EP-389821)

1. A continuous thin sheet of a TiAl intermetallic compound consisting of from 35 to 44 wt% Al and the balance Ti and unavoidable impurities, having a thickness of from 0.2 to 3 mm, and having a solidified, as-cast structure comprising columnar crystals extending from both surfaces of the sheet toward the center of the sheet thickness.
2. A process for producing a continuous thin sheet of a TiAl intermetallic compound comprising the steps of:
heating a mixture consisting of from 35 to 44 wt% Al and the balance Ti in an inert gas atmosphere to form a melt,
continuously feeding the melt to an open-ended mold defined by a pair of cooling rolls and a pair of side dams, the rolls rotating at a peripheral speed of from 0.1 to 10 m/sec, and
cooling the melt within the mold by the cooling rolls while a constant force is applied to the rolls to form a solidified sheet having a thickness corresponding to a distance between the rolls.
3. A process according to claim 2, wherein said cooling of the melt within the mold is effected at a rate of from 10^{**2} to 10^{**5} DEG.C/sec.
4. A process according to claim 2 or 3, wherein said heating of the mixture is carried out at a temperature of from 1500 to 1600 DEG.C.
5. A process according to any one of claims 2 to 4, wherein the melt temperature is adjusted to a temperature of from 1400 to 1500 DEG.C prior to said feeding of the melt to said open-ended mold.
6. A process according to any one of claims 2 to 5, wherein the melt is fed to the mold through a feeding nozzle in the form of a slit.
7. A process according to any one of claims 2 to 6, wherein said inert gas is Ar or He.
8. A process according to any one of claims 2 to 7, wherein said constant force is applied by a spring.