Number of documents: 68

EP1462537	Process of treatment of an Al alloy surface, particularly a piece of TiAl alloy, and application of organic halocarbon compounds or halogenides bound in an organic matrix DECHEMA DEUTSCHE GESELLSCHAFT FÜR CHEMISCHES APPARATEWESEN CHEMISCHE TECHNIK & BIOTECHNOLOGIE & V DECHEMA GES CHEMISCHE TECHNIK DECHEMA GES FUR CHEMISCHE TECHNOLOGY
JP07083330	TiAl-based intermetallic compound piston ring and process for treating the surfaces thereof HONDA MOTOR
EP1127949	TiAl based alloy, production process therefor, and rotor blade using same MITSUBISHI HEAVY INDUSTRIES
EP2695704	Method for manufacturing a TIAL blade ring segment for a gas turbine and corresponding blade ring segment MTU AERO ENGINES
WO201320548	Method for producing forged tial components MTU AERO ENGINES
DE102010026084	Process and apparatus for applying layers of material to a workpiece made of tial MTU AERO ENGINES
DE102008056741	Wear-resistant layer for tial MTU AERO ENGINES
WO2009113335	Tial-based alloy, process for production of the same, and rotor blade comprising the same MITSUBISHI HEAVY INDUSTRIES TOKYO INSTITUTE OF TECHNOLOGY
WO200188214	$g(G)- TIAL ALLOY-BASED COMPONENT COMPRISING AREAS HAVING A GRADUATED STRUCTURE GFE MET & MAT GFE METALLE & MATERIALIEN
AT---2881U	Process for producing a TiAl-based alloy poppet valve MAERKISCHES WERK RACING MARKISCHES WERK RACING PLANSEE
EP2584056	Titanium aluminide application process and article with titanium aluminide surface GENERAL ELECTRIC
EP2014460	Method for protecting the surface of an intermetallic alloy substrate with a titanium- aluminide base against corrosion ONERA - OFFICE NATIONAL D'ETUDES & DE RECHERCHES AEROSPATIALES
EP1507062	Bonding of a titanium aluminide turbine rotor to a steel shaft BORG WARNER
EP-816007	Method of friction-welding a shaft to a titanium aluminide turbine rotor IHI-ISHIKAWAJIMA HARIMA HEAVY INDUSTRIES
CA2645843	Titanium aluminide alloys GKSS FORCHUNGSZENTRUM GEESTHACHT GKSS FORSCHUNGSZENTRUM GKSS FORSHUNGSTSENTRUM GEESTKHAKHT HELMHOLTZ ZENTRUM GEESTHACHT
EP2808488	TiAl blade with surface modification MTU AERO ENGINES
WO2013152750	Method for producing low-pressure turbine blades from tial

	MTU AERO ENGINES
DE102011087158	Method for hardfacing the z-notch of tial blades MTU AERO ENGINES
WO201371909	Armoring sealing fins of tial vanes by induction brazing hard-material particles MTU AERO ENGINES
DE102009032564	Method for reinforcing components from a TiAl base material and corresponding components MTU AERO ENGINES
EP1002935	TiAl-rotor of a turbomachine and method of manufacturing ABB
DE102012201082	Method for producing forged components from a tial alloy and component produced thereby MTU AERO ENGINES
US20150147186	Silicon carbide-containing mold and facecoat compositions and methods for casting titanium and titanium aluminide alloys GENERAL ELECTRIC
US20130121869	Multicomponent titanium aluminide article and method of making GENERAL MOTORS
US20120301307	Friction welding of titanium aluminide turbine to titanium alloy shaft CATERPILLAR
US7156282	Titanium- aluminide turbine wheel and shaft assembly, and method for making same HONEYWELL
EP1621774	Titanium aluminide wheel and steel shaft connection thereto BORG WARNER
CA2496093	Method for manufacturing of workpieces or semifinished products containing titanium aluminide alloys and products made thereby GKSS FORSCHUNGSZENTRUM GKSS FORSHUNGSTSENTRUM GEESTKH HELMHOLTZ ZENTRUM GEESTHACHT
CA2010672	Improved titanium aluminide alloys. GENERAL ELECTRIC
CA2810169	Titanium aluminide intermetallic compositions GENERAL ELECTRIC
CA2852910	Mold compositions and methods for casting titanium and titanium aluminide alloys GENERAL ELECTRIC
WO200946699	Joining and material application method for a workpiece having a workpiece region comprising a titanium aluminide alloy ACCESS & V ACCESS EV BORG WARNER TURBO SYSTEMS ENGI
WO200656248	Titanium aluminide based alloy CAR GAME FOLDER SHUN SS GUSS ZENTRUM DOVE GAME STORE GKSS FORSCHUNGSZENTRUM GKSS FORSHUNGSTSENTRUM GEESTKH
DE102013020460	Method for producing titanium-aluminum components HANSEATISCHE WAREN HANDELSGMBH
US20150044505	TiAl JOINED BODY AND MANUFACTURING METHOD FOR TiAl JOINED BODY MITSUBISHI HEAVY INDUSTRIES
JP2002356729	The TiAl basic alloy and its production method and the rotor blade which uses that MITSUBISHI HEAVY INDUSTRIES
JP3106196	MANUFACTURE OF SINTERED COMPACT OF TiAl-Ti ALLOY AGENCY OF INDUSTRIAL SCIENCE & TECHNOLOGY TOHOKU STEEL
EP-837221	Ti-Al turbine rotor and method of manufacturing said rotor DAIDO STEEL
FR3019561	Heat treatment of an alloy based on titanium aluminide

	SNECMA
WO2014149292	Titanium aluminide turbine exhaust structure UNITED TECHNOLOGIES
EP2762684	Seal mount made from from titanium aluminide for a flow machine MTU AERO ENGINES
DE102012222745	Turbine blade, useful in fluid-flow machine e.g. stationary gas turbine or aircraft engine, comprises monocrystalline of titanium aluminide material in blade portion, and blade root made of polycrystalline material MTU AERO ENGINES
CA2848838	Titanium aluminide articles with improved surface finish and methods for their manufacture GENERAL ELECTRIC
US20070033937	Composite rotor for exhaust-gas turbochargers having titanium aluminide wheels DAIMLER
DE102005005666	Turbocharger, has turbine wheel as integral part of shaft, and compressor wheel connected with shaft by circular wedge connection, where turbine wheel and shaft are manufactured from high temperature-firm material e.g. titanium aluminide DAIMLER
WO9845081	Friction welding interlayer and method for joining gamma titanium aluminide to steel, and turbocharger components thereof NGUYEN DINH XUAN XUAN NGUYEN DINH
US5873703	Repair of gamma titanium aluminide articles GENERAL ELECTRIC
JP09076079	It is low connecting method of the alloy steel shaft or the steel shaft and chitanaruminaido make body of revolution IHI-ISHIKAWAJIMA HARIMA HEAVY INDUSTRIES
US5431752	Friction welding of .gamma. titanium aluminide to steel body with nickel alloy connecting piece there between ABB SCHWEIZ
JP04041682	Suction and exhaust valve for internal-combustion engine made of titanium aluminide SUMITOMO LIGHT METAL INDUSTRIES
JP11320132	Connecting method and connecting part of TiAl alloy component and steel for structure MITSUBISHI HEAVY INDUSTRIES
JP2015168835	TURBINE WHEEL MADE OF TiAl DAIDO STEEL
EP2924134	Ti-Al-based heat-resistant member DAIDO STEEL
WO2014203714	Hot-forged ti-al-based alloy and method for producing same NATIONAL INSTITUTE FOR MATERIALS SCIENCE
EP2423340	Process and system for fabricating gamma tial turbine engine components UNITED TECHNOLOGIES
JP2010270347	TiAl ALLOY FOR AIR INTAKE/EXHAUST VALVE AND METHOD FOR MANUFACTURING THE SAME HONDA MOTOR
JP2005082824	METHOD FOR REFORMING SURFACE OF TiAl-BASED ALLOY INTO HIGH-TEMPERATURE OXIDIZATION RESISTANT SURFACE, AND SURFACE-REFORMED PRODUCT IHI-ISHIKAWAJIMA HARIMA HEAVY INDUSTRIES ION ENGINEERING RESEARCH INSTITUTE
JP2004090130	JOINING METHOD FOR TiAL-BASE ALLOY AND STEEL PRODUCT MITSUBISHI HEAVY INDUSTRIES
JP2002053976	OXIDATION RESISTANCE COATING FOR TiAl-BASED ALLOY MITSUBISHI HEAVY INDUSTRIES
JP08074531	Tial radical alloy-made engine valve and manufacture theroof

	NISSAN MOTOR
JP06002095	Manufacture of parts for automotive engine made of tial alloy AISAN INDUSTRY NKK - NIPPON KOKAN TOYOTA MOTOR
JP05345936	Production of alloy based on tial as intermetallc compound KOBE STEEL
WO2007134596	Method for treating surfaces of titanium-aluminum alloys with fluoride or fluoride compounds DECHEMA DEUTSCHE GESELLSCHAFT FÜR CHEMISCHES APPARATEWESEN CHEMISCHE TECHNIK & BIOTECHNOLOGIE & V DECHEMA GESELLSCHAFT FÜR CHEMISCHE TECHNIK & BIOTECHNOLOGIE & V
GB200201061	Arrangement of vane and blade aerofoils in a turbine exhaust section ALSTOM SIEMENS
JP09176764	Ti-al base intermetallic compound matrix alloy MITSUBISHI HEAVY INDUSTRIES
JP08199370	Oxidation resistant film of titanium-aluminum AISIN SEIKI
JP08199371	Oxidation resistant film of titanium-aluminum AISIN SEIKI
JP03075385	Parts for machine sliding part made of tial-base alloy SUMITOMO METAL INDUSTRIES

Process of treatment of an Al alloy surface, particularly a piece of TiAl alloy, and application of organic halocarbon compounds or halogenides bound in an organic matrix

EP1462537

- **Patent Assignee**
  DECHEMA DEUTSCHE GESELLSCHAFT FÜR CHEMISCHES APPARATEWESEN CHEMISCHE TECHNIK & BIOTECHNOLOGIE & V DECHEMA GES CHEMISCHE TECHNIK DECHEMA GES FUR CHEMISCHE TECHNOLOGY
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- **International Patent Classification**
  C23C-008/40 C23C-008/42 C23C-008/60 C23C-008/62 F01D-005/28
- **CPC Code**
  C23C-008/40 C23C-008/40; C23C-008/60; F01D-025/00/7; F02C-007/30
- **Publication Information**
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- **Priority Details**
  2003DE-1012853 2003-03-21
  2003DE-1051946 2003-11-07

- **Fampat family**

EP1462537	A2	2004-09-29	[EP1462537]
DE10351946	A1	2004-10-07	[DE10351946]
EP1462537	A3	2006-06-07	[EP1462537]
EP1462537	B1	2008-04-02	[EP1462537]
AT391194	T	2008-04-15	[ATE391194]
DE502004006702	D1	2008-05-15	[DE502004006702]
PT1462537	E	2008-05-28	[PT1462537]
ES2303610	T3	2008-08-16	[ES2303610]

- **Abstract:**
  (EP1462537)
  Aluminum alloys e.g. aluminum-titanium alloys for aero-engines, have oxidation resistance improved by coating with organic halogen compound and heating Articles of aluminum alloy are shaped at normal temperatures and then have an organic halogen-carbon compound, or a matrix containing such a compound, applied to the surface. The article is then heated up to at least 700 degrees C so that the halogen combines with the aluminum and the organic components evaporate. Heating can take place when the article is in use for the first time. An Independent claim is also included for the use of this process to improve the oxidation resistance of aluminum alloys, especially titanium-aluminum alloys. Application of organic halogen compounds can be by brush, spraying or dipping to produce between 3.5x10-12 and 6.5x10-4 mol fluorine/cm2.

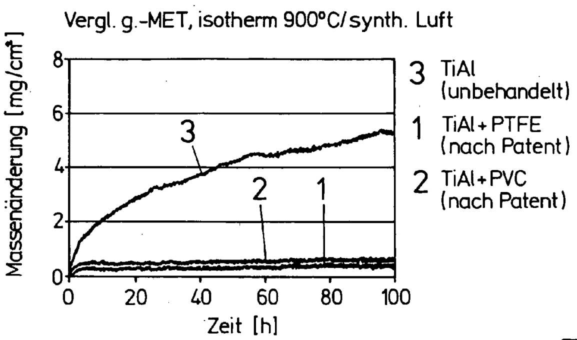

Fig.1

Claims

(EP1462537)

1. Process for the treatment of the surface of a structural part consisting of a TiAl alloy for improving its resistance to oxidation, with the following steps: provision, at normal temperature, of the structural part to be treated applying organic halogenated carbon compounds or halides bound into an organic matrix onto the surface of the structural part, heating the structural part to a temperature of at least 700 deg.C.
2. Process according to claim 1 characterised in that the heating provided for after applying organic halogenated carbon compounds or halides bound into an organic matrix is carried out for the first time during the appropriate use.
3. Process according to one of claims 1 or 2 characterised in that a fluorinated carbon compound is used by means of which a fluorine concentration of between 3.5 x 10-12 mole fluorine/cm **2 and 6.5 x 10-4 mole fluorine/cm **2 is adjusted on the material surface.
4. Process according to one of claims 1 to 3 characterised in that the halogen compound is applied by an immersion process, by brush application with a brush, by a spray process, by another known application process or by a combination of several application processes.
5. Use of organic halogenated carbon compounds or halides bound into an organic matrix for the treatment of the surface of structural parts consisting of a TiAl alloy, which structural parts are intended to be used at temperatures of at least 700 deg.C, for improving the resistance to oxidation of these structural parts.
6. Use according to claim 5 characterised in that the structural parts are intended to be used at temperatures of maximum 1100 deg.C.
7. Use according to one of claims 5 or 6 characterised in that the alloy contains, besides titanium, between 20 and 75 at% of aluminium and, in total, between 0 and 30 at% of further alloying additives.
8. Use according to claim 7 characterised in that the elements of boron or chromium or iron or carbon or copper or magnesium or manganese or molybdenum or niobium or phosphorus or silver or silicon or tantalum or vanadium or tungsten or yttrium or zirconium or a combination of several of the heretofore mentioned elements may be present in the alloy as further alloying additives.

TiAl-based intermetallic compound piston ring and process for treating the surfaces thereof

JP07083330

- **Patent Assignee**
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- **Inventor**
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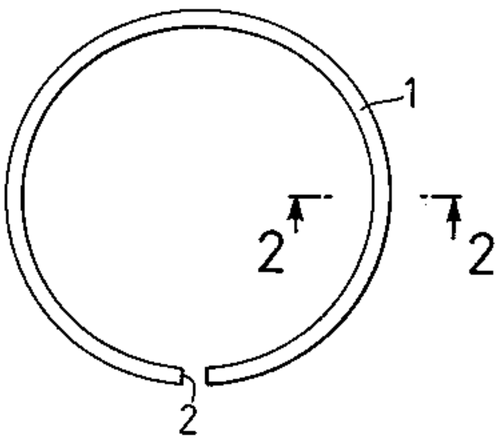
  KANOYA IZURU
- **International Patent Classification**
  C22C-014/00 C22C-019/00 C23C-014/00 C23C-014/02 C23C-014/06 C23C-014/32 F02F-005/00 F16J-009/26
- **CPC Code**
  C22C-019/00; C23C-014/00/21; C23C-014/06/41; F05C-2201/021; F05C-2201/0412; F16J-009/26
- **Publication Information**
  JPH0783330 A 1995-03-28 [JP07083330]
- **Priority Details**
  1993JP-0231449 1993-09-17
  1994JP-0035082 1994-03-04

- **Fampat family**

JPH0783330	A	1995-03-28	[JP07083330]
EP0645463	A2	1995-03-29	[EP-645463]
EP0645463	A3	1995-05-17	[EP-645463]
JPH07243020	A	1995-09-19	[JP07243020]
EP0645463	B1	1997-12-29	[EP-645463]
DE69407525	D1	1998-02-05	[DE69407525]
DE69407525	T2	1998-04-16	[DE69407525]

- **Abstract:**
  (EP-645463)
  A piston ring for an internal combustion engine is formed of a TiAl-based intermetallic compound having a volume fraction Vf of L10 type TiAl (gamma -phase) in a range represented by Vf >/= 30%. Such piston ring has a light weight, a high rigidity and a high limit of the number of revolutions (rpm) of the engine. The piston ring is subjected to a thermal treatment, preferably between about 500 DEG C and 900 DEG C, and then a thin film of titanium nitride, chromium nitride, titanium-aluminum nitride or the like is formed on the surfaces by a physical vapor deposition process, such as ion-plating.. <IMAGE>

FIG.1



Claims

(EP-645463)

1. A piston ring formed of a TiAl-based intermetallic compound having a volume fraction Vf of L10 type TiAl represented by Vf >= 30%.
2. A piston ring according to claim 1, wherein said volume fraction Vf of Ll0 type TiAl is in a range represented by Vf >= 40%.
3. A process for treating a surface of a piston ring made of a TiAl-based intermetallic compound, comprising a step of forming a thin film on a surface of the piston ring by a physical vapor deposition, wherein a residual strain in said piston ring is removed by subjecting said piston ring to a thermal treatment prior to the formation of the thin film by said physical vapor deposition.
4. A process for treating a surface of a piston ring made of a TiAl-based intermetallic compound according to claim 3, wherein a thermal treatment temperature T in said thermal treatment is set in a range represented by 500 DEG.C <= T <= 900 DEG.C.
5. A process for treating a surface of a piston ring made of a TiAl-based intermetallic compound according to claim 3 or 4, wherein said physical vapor deposition is an ion-plating.
6. A process for treating a surface of a piston ring made of a TiAl-based intermetallic compound according to claim 3, or 4, wherein said thin film is formed of a nitride selected from the group consisting of titanium nitride, chromium nitride and titanium-aluminum nitride.
7. A process for treating a surface of a piston ring made of a TiAl-based intermetallic compound according to claim 5, wherein said thin film is formed of a nitride selected from the group consisting of titanium nitride, chromium nitride and titanium-aluminum nitride.
8. A piston ring according to claim 1 or 2, wherein said TiAl-based intermetallic compound is substantially Ti49.6 Al4 5 V2 Nb2 B1.4 .
9. A piston ring according to the process of claim 3 or 4, wherein said TiAl-based intermetallic compound is Ti49.6 Al4 5 V2 Nb2 B1.4 .
10. A piston ring formed of a TiAl-based intermetallic compound having a volume fraction Vf of L10 type TiAl represented by Vf >= 30% and having a thin film formed on a surface of the piston ring by a physical vapor deposition, wherein said piston ring is subjected to a thermal treatment prior to the formation of said thin film for removing a residual strain in said piston ring.
11. A piston ring according to claim 10, wherein a thermal treatment temperature T in said thermal treatment is set in a range represented by 500 DEG.C <= T <= 900 DEG.C.
12. A piston ring according to claim 10 or 11, wherein said physical vapor deposition is an ion-plating.
13. A piston ring according to claim 10 or 11, wherein said thin film is formed of a nitride selected from the group consisting of titanium nitride, chromium nitride and titanium-aluminum nitride.

TiAl based alloy, production process therefor, and rotor blade using same
EP1127949

- **Patent Assignee**
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- **Inventor**
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  SHINDO KENTARO
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- **International Patent Classification**
  B21J-005/00 B21K-003/04 C22C-014/00 C22C-021/00 C22F-001/00 C22F-001/04 C22F-001/18 F01D-005/28 F02B-039/00
- **US Patent Classification**
  PCLO=148421000 PCLO=148670000 PCLX=148671000 PCLX=420418000 PCLX=420420000
- **CPC Code**
  B21J-001/02/5; B21K-003/04; C22C-014/00; C22C-021/00; C22F-001/04

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  2000JP-0046540 2000-02-23
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  2001US-09789540 2001-02-22
  2003US-10667651 2003-09-23

- **Fampat family**

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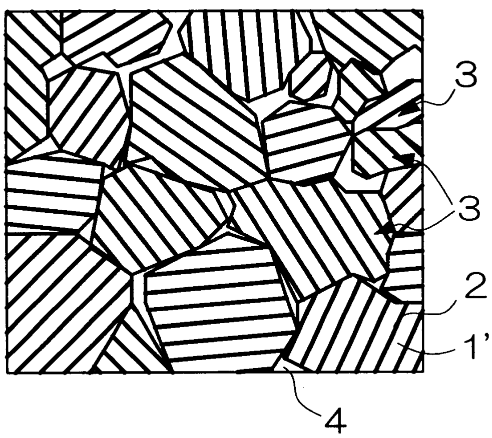
JP2001316743	A	2001-11-16	[JP2001316743]
EP1127949	A3	2002-09-18	[EP1127949]
US6669791	B2	2003-12-30	[US6669791]
US2004055676	A1	2004-03-25	[US20040055676]
EP1127949	B1	2005-04-27	[EP1127949]
DE60110294	D1	2005-06-02	[DE60110294]
DE60110294	T2	2006-03-09	[DE60110294]
JP4287991	B2	2009-07-01	[JP4287991]
US7618504	B2	2009-11-17	[US7618504]

- **Abstract:**
  (EP1127949)
  A TiAl based alloy having excellent strength as well as an improvement in toughness at room temperature, in particular an improvement in impact properties at room temperature, and a production method thereof, and a blade using the same are provided. This TiAl based alloy has a microstructure in which lamellar grains having a mean grain diameter of from 1 to 50m are closely arranged. The alloy composition is Ti-(42-48)Al-(5-10) (Cr and/or V) or Ti-(38- 43)Al-(4-10)Mn. The alloy can be obtained by subjecting the alloy to high-speed plastic working in the cooling process, after the alloy has been held in an equilibrium temperature range of the alpha phase or the (alpha + beta) phase.



Claims

(EP1127949)

1. A TiAl based alloy having a microstructure in which lamellar grains having a mean grain diameter of from 1 to 50m are closely arranged, with an alpha 2 phase and a gamma phase being laminated therein alternately.
2. A TiAl based alloy according to claim 1, having a microstructure in which lamellar grains having a mean grain diameter of from 1 to 50m are closely arranged, with an alpha 2 phase and a gamma phase being laminated therein alternately, and a matrix comprising a beta phase filling the gaps between the lamellar grains.
3. A TiAl based alloy according to claim 1, comprising 40 to 48 atomic % of Al, 5 to 10 atomic % of one or more kinds selected from Cr and V, with the remainder being Ti and inevitable impurities.
4. A TiAl based alloy according to claim 1, comprising 38 to 48 atomic % of Al, 4 to 10 atomic % of Mn, with the remainder being Ti and inevitable impurities.
5. A TiAl based alloy according to claim 3, containing one or more kinds of elements selected from the group consisting of C, Si, Ni, W, Nb, B, Hf, Ta, and Zr in an amount of from 0.1 to 3 atomic % in total.
6. A TiAl based alloy according to claim 4, containing one or more kinds of elements selected from the group consisting of C, Si, Ni, W, Nb, B, Hf, Ta, and Zr in an amount of from 0.1 to 3 atomic % in total.
7. A TiAl based alloy according to any one of claims 1 to 5, wherein a Charpy impact test value specified in JIS-Z2242 is 3J or higher at room temperature.
8. A production method of a TiAl based alloy comprising:
a step for holding a TiAl based alloy material containing Al at least in an amount of from 43 to 48 atomic % in an equilibrium temperature range of an alpha phase;
and
a step for subjecting the TiAl based alloy material held at that temperature to high-speed plastic working, while cooling the material to a predetermined working terminal temperature.
9. A production method of a TiAl based alloy according to claim 8, wherein said holding temperature is from 1230 DEG.C to 1400 DEG.C.
10. A production method of a TiAl based alloy according to claim 8, wherein said working terminal temperature is 1200 DEG.C.
11. A production method of a TiAl based alloy according to claim 8, wherein said TiAl based alloy material is held at said holding temperature with the material being covered with a thermal insulation material, and then said TiAl based alloy is subjected to high-speed plastic working, together with said thermal insulation material.
12. A production method of a TiAl based alloy according to claim 8, wherein a forging method is used as said high-speed plastic working.
13. A production method of a TiAl based alloy according to claim 8, wherein said high-speed plastic working is performed at a cooling speed of from 50 to 700 DEG.C/min.
14. A production method of a TiAl based alloy comprising:
a step for holding a TiAl based alloy material containing Al at least in an amount of from 38 to 44 atomic % in an equilibrium temperature range of a (alpha + beta) phase;
and a step for subjecting the TiAl based alloy material held at said temperature to high-speed plastic working, while cooling said material to a predetermined working terminal temperature.
15. A production method of a TiAl based alloy according to claim 14, wherein said holding temperature is from 1150 DEG.C to 1300 DEG.C.
16. A production method of a TiAl based alloy according to claim 14, wherein said working terminal temperature is 1000 DEG.C.
17. A production method of a TiAl based alloy according to claim 14, wherein a forging method is used as said high-speed plastic working.
18. A production method of a TiAl based alloy according to claim 14, wherein said high-speed plastic working is performed at a cooling speed of from 50 to 700 DEG.C/min.
19. A blade using the TiAl based alloy according to any one of claims 1 to 7.

Method for manufacturing a TIAL blade ring segment for a gas turbine and corresponding blade ring segment

EP2695704

- **Patent Assignee**
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- **Inventor**
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- **International Patent Classification**
  B23P-015/00 C22F-001/18 F01D-005/04 F01D-005/14 F01D-005/28
- **US Patent Classification**
  PCLO=415200000 PCLX=029889700
- **CPC Code**
  B23P-015/00/6; C22F-001/18/3; F01D-005/04/8; F01D-005/14/6; F01D-005/22; F01D-005/28; Y02T-050/672; Y02T-050/673; Y10T-029/49336
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  2012EP-0179785 2012-08-09

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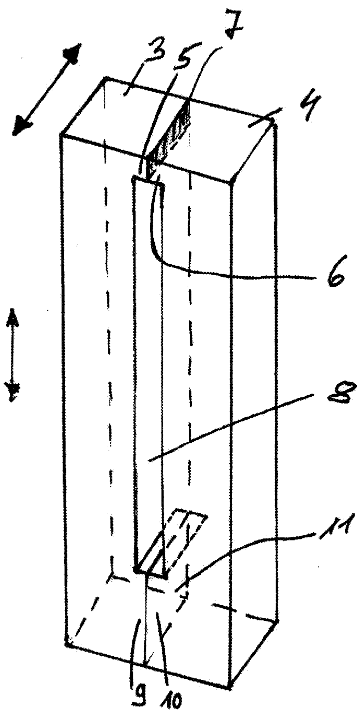
EP2695704	A1	2014-02-12	[EP2695704]
US2014044532	A1	2014-02-13	[US20140044532]
EP2695704	B1	2015-02-25	[EP2695704]
ES2532582	T3	2015-03-30	[ES2532582]

- **Abstract:**
  (EP2695704)
  The method comprises forming blanks (3) of titanium-aluminum material, joining the blanks to a blade ring segment by a cohesive connection and then performing heat treatment, and post-processing the blank composite by material processes. The joining step is carried out by laser beam welding, electron-beam welding, high temperature brazing or friction welding, linear friction welding, orbital friction welding or multi-orbital friction welding. The titanium aluminum material is preheated at a brittle ductile transition temperature of the titanium aluminum during the laser beam welding. The method comprises forming blanks (3) of titanium-aluminum material, joining the blanks to a blade ring segment by a cohesive connection and then performing heat treatment, and post-processing the blank composite by material processes. The joining step is carried out by laser beam welding, electron-beam welding, high temperature brazing or friction welding, linear friction welding, orbital friction welding or multi-orbital friction welding. The titanium aluminum material is preheated at a brittle ductile transition temperature of the titanium aluminum during the laser or electron beam welding. The method further comprises soldering titanium-nickel base by inductive heating. The blanks are formed as a cube, a cuboid with protruding joint zones or as final contour components. An independent claim is included for a blade ring segment for a gas turbine.



Claims

(EP2695704)

1. A method for producing a blade-ring segment for a gas turbine, in particular for an aircraft engine, having at least two adjacent blades (21, 22) that have a single common blade root (25), wherein the method includes the following method steps: - forging of at least two blanks (1,2;3,4), - joining of the blanks to form a blade-ring segment by means of a method for substance-closing connection, and - re-processing of the blank composite by means of material-removing methods, characterised in that
the at least two blanks (1,2;3,4) are forged from a TiAl-material,
and during the joining of the blanks a joining zone (11) develops that extends through the centre or a central region of the common blade root (25).

2. A method according to claim 1,
characterised in that
one or more heat-treatments are carried out between the step of joining and re-processing by means of material-removing methods or after the re-processing by means of material-removing methods.

3. A method according to claim 1 or 2,
characterized in that
the joining is effected by laser-beam welding, electron-beam welding, high-temperature soldering or friction-welding, in particular linear friction-welding, orbital friction-welding or multi-orbital friction-welding.

4. A method according to one of the preceding claims,
characterised in that
the TiAl-material is pre-heated during the laser-beam or electron-beam wielding above the brittle-to-ductile transition temperature of the TiAl-material.

5. A method according to claim 3,
characterised in that
the soldering is carried out by means of local heating, in particular by means of inductive heating.

6. A method according to one of claims 3 or 5,
characterised in that
in particular Ti- or Ni-based solders are used for the soldering.

7. A method according to one of the preceding claims,
characterised in that
the blanks are formed as cuboids, as cuboids with protruding joining zones or as components with close to final contours.

8. A blade-ring segment for a gas turbine, in particular for an aircraft engine, consisting of a TiAl-material having at least two adjacent blades, prcduced in accordance with the method according to one of the preceding claims,
wherein at least two adjacent blades have a single common blade root, and wherein a joining zone (11) extends through the centre or a central region of the common blade root (25).

Method for producing forged tial components
WO201320548

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- **US Patent Classification**
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WO2013020548	A1	2013-02-14	[WO201320548]
DE102011110740	A1	2013-02-14	[DE102011110740]
WO2013020548	A8	2013-07-18	[WO201320548]
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US2014202601	A1	2014-07-24	[US20140202601]
EP2742162	B1	2015-10-07	[EP2742162]
ES2553439	T3	2015-12-09	[ES2553439]

- **Abstract:**
  (EP2742162)
  The present invention relates to a method for producing forged components of a **TiAl** alloy, in particular turbine blades, wherein the components are forged and undergo a two-stage heat treatment after the forging process, the first stage of the heat treatment comprising a recrystallization annealing process for 50 to 100 minutes at a temperature below the / transition temperature, and the second stage of the heat treatment comprising a stabilization annealing process in the temperature range of from 800° C. to 950° C. for 5 to 7 hrs, and the cooling rate during the first heat treatment stage being greater than or equal to 3° C./sec, in the temperature range between 1300° C. to 900° C. (From US2014202601 A1)

Claims

(EP2742162)

1. A method for producing forged components from a TiAl alloy, in particular turbine blades, in which the components are forged and after forging are subjected to a two-stage heat-treatment, wherein the first stage of the heat-treatment comprises recrystallization annealing for 50 to 100 minutes at a temperature below the gamma /alpha - transition temperature, namely in the temperature range between 1300 deg.C and 900 deg.C, in particular a recrystallization cooling temperature between 1200 deg.C and 1300 deg.C, and the second stage of the heat-treatment comprises stabilization annealing in the temperature range of 800 deg.C to 950 deg.C for 5 to 7 hours, and wherein a TiAl alloy having 42 to 45 at. % aluminium, 3 to 5 at. % niobium and 0.5 to 1.5 at. % molybdenum is used, characterised in that the rate of cooling in the first heat-treatment stage is greater than or equal to 3 deg.C/s in order to set a fine lamellar structure of alpha 2-Ti3Al and gamma -TiAl in a corresponding alpha 2-and gamma -phase.

2. A method according to claim 1,
characterised in that
the recrystallization annealing is carried out for 60 to 90 minutes, in particular 70 to 80 minutes, and/or the stabilization annealing is carried out in the temperature range of 825 deg.C to 925 deg.C, in particular 850 deg.C to 900 deg.C, and/or for 345 to 375 minutes.

3. A method according to one of the preceding claims,
characterised in that
the temperature during the heat-treatment is set and held with an accuracy of a 5 deg.C to 10 deg.C upward and downward deviation from the desired temperature.

4. A method according to one of the preceding claims,
characterised in that
during the recrystallization annealing there is no fall below a temperature of 15 deg.C, in particular 10 deg.C, below the gamma /alpha transition temperature.

5. A method according to one of the preceding claims,
characterised in that
an alloy having C.05 to 0.15 at. % boron is used.

6. A method according to one of the preceding claims,
characterised in that
the component is produced by drop-forging in the alpha -gamma -beta -temperature range.

7. A method according to one of the preceding claims,
characterised in that
cast or hot-isostatically pressed blanks are used as the starting material for the forging.

8. A method according to one of the preceding claims,
characterised in that
after the second stage of the heat-treatment the component has a triplex structure, with a glabulitic gamma -TiAl phase, a B2-TiAl phase and a lamellar alpha 2-Ti 3Al and gamma -TiAl phase.

9. A method according to claim 8,
characterised in that
the proportion of the gamma -phase is 2 to 20 percent by volume, the proportion of the B2-phase is 1 to 20 percent by volume, and the proportion of the gamma -phase together with the B2-phase is 5 to 25 percent by volume.

Process and apparatus for applying layers of material to a workpiece made of tial DE102010026084

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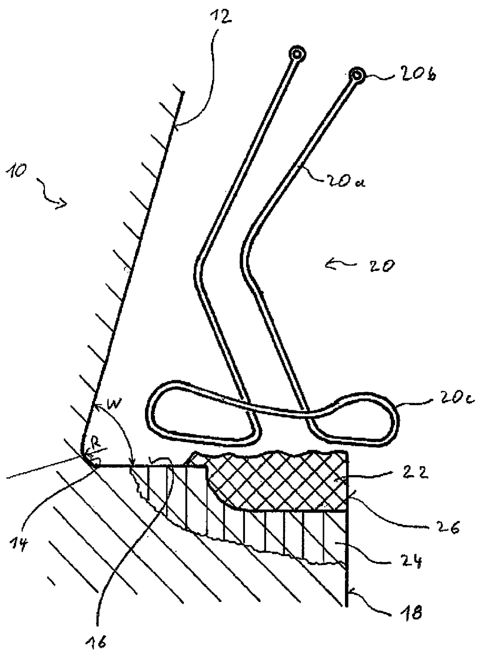
- **Fampat family**

DE102010026084	A1	2012-01-05	[DE102010026084]
WO2012069029	A2	2012-05-31	[WO201269029]
WO2012069029	A3	2012-07-26	[WO201269029]
EP2590773	A2	2013-05-15	[EP2590773]
US2013143068	A1	2013-06-06	[US20130143068]

- **Abstract:**
  (US20130143068)
  Applying at least one material layer on a workpiece (10) made of a material containing **titanium aluminide**, comprises: heating the workpiece in a locally restricted area by induction at a provided preheating temperature; and applying a powdery additive on the heated surface of the workpiece by deposition welding, preferably laser-, laser-powder-, plasma-, micro plasma-, tungsten inert gas or micro tungsten inert gas-deposition welding, where the additive comprises **titanium aluminide**. Independent claims are also included for: (1) surface finishing, plating, dimensional correction or repairing the workpiece, comprising preparing the workpiece, and applying at least one layer of the additive; (2) plating, dimensional correction or repairing the surface of a shank, preferably acute angled groove of a component made of the material containing **titanium aluminide**, where a zone of the workpiece in a region of a groove-radius (14) is not heated by a predetermined additional critical temperature of the material depending on the shape of the groove, and a coil is used for inductive heating of the workpiece and/or its position is adjusted relative to the groove in the groove, preferably its shape; (3) plating, dimensional correction or repairing a functional area of a Z-groove of a top cover strip of a turbine blade, a sealing fin on a turbine bladed discs, a blade tip of a compressor rotor blade or a portion of a casing of a turbo-machine; (4) producing a workpiece, preferably a turbine- or compressor blade, or a turbine- or compressor housing, or any of their parts,



comprising preparing a substrate made of the material containing **titanium aluminide**, and applying a layer of at least one additive until a predetermined contour of the workpiece is formed or packed; (5) a device for applying material layers on the workpiece by deposition welding, comprising a holding device for holding the workpiece, a feeding device for feeding a powdery, **titanium aluminide**-containing additive, a melting device for melting the additive, where the melting device is arranged for generating a laser- or plasma jet and for directing the laser- or plasma jet on the workpiece, and a preheating device for preheating the workpiece. A device is designed and equipped for carrying out the above mentioned method. The preheating device is designed and equipped for inductive, locally restricted heating the surface of the workpiece; and (6) a workpiece with at least one material layer. (From DE102010026084 A1)

Claims

(US20130143068)

18. A method for depositing at least one layer of material on a workpiece made of a material including a titanium aluminide, the method comprising the steps of: heating the workpiece in a localized region by induction to a predefined preheating temperature, the heating creating a heated surface of the workpiece; and

depositing an additive including titanium aluminide on the heated surface of the workpiece by build-up welding.

1-17. (canceled)

19. The method as recited in claim 18 wherein the build-up welding includes at least one of: laser build-up welding, laser powder build-up welding, plasma build-up welding, micro-plasma build-up welding, TIG build-up welding and micro-TIG build-up welding
20. The method as recited in claim 18 wherein the additive is in powder form.
21. The method as recited in claim 18 wherein the preheating temperature is at or above a critical temperature of a brittle-ductile phase transition of the material.
22. The method as recited in claim 21 wherein the preheating temperature is between 700 deg. C. and 800 deg. C.
23. The method as recited in claim 18 wherein the preheating temperature is below a predetermined second critical temperature of the material.
24. The method as recited in claim 18 wherein the additive includes a hard material.
25. The method as recited in claim 24 wherein the content of hard material in the additive is between 15% and 90%.
26. The method as recited in claim 25 wherein the hard material is titanium carbide.
27. The method as recited in claim 24 wherein the hard material includes at least one of titanium carbide, titanium boride and boron nitride.
28. The method as recited in claim 18 wherein the additive includes a titanium aluminide having an average grain size of 25 to 75 mu m.
29. The method as recited in claim 28 wherein the additive includes a titanium carbide having an average grain size of 3 to 45 mu m.
30. The method as recited claim 18 wherein the deposition step includes the steps of: depositing the additive in powder form on the surface of the workpiece; and

melting the deposited additive by a laser beam or a plasma jet.

31. The method as recited in claim 18 wherein during the deposition step, the additive in powder form is delivered through a nozzle coaxial with a laser beam or plasma or laterally to a laser beam or plasma jet.
32. The method as recited in claim 18 wherein the addition of the additive and its composition are controlled in such a way that they vary from region to region.
33. The method as recited in claim 18 wherein a power of a laser used in the method is 80 W to 4000 W.
34. The method as recited in claim 18 wherein an advance rate is between 100 and 1500 mm/min.
35. The method as recited in claim 18 wherein the additive is deposited in a plurality of adjacent lines.
36. The method as recited in claim 35 wherein the lines have a width of 0.2 to 5 mm and/or a thickness of 0.1 to 3 mm.
37. The method as recited in claim 36 wherein the lines overlap each other.
38. The method as recited in claim 37 wherein a degree of overlap of adjacent lines is 50 to 90%.
39. The method as recited in claim 18 wherein the deposition step is followed by a step of cooling the workpiece at a defined cooling rate to a cooling temperature.
40. The method as recited in claim 39 wherein the cooling temperature is between 500 deg. C. and 650 deg. C.
41. The method as recited in claim 39 wherein the cooling rate is between 5 K/min and 50 K/min.
42. The method as recited in claim 39 wherein the cooling step wherein the cooling temperature is higher than room temperature and further includes a step of uncontrolled further cooling to room temperature.
43. The method as recited in claim 18 wherein the material consists of the titanium aluminide.
44. A method for surface enhancement, hardfacing, dimensional correction, or repair of a workpiece, the method comprising the steps of: preparing the workpiece; and

depositing at least one layer of an additive using the method as recited in claim 18.

45. A method for surface enhancement, hardfacing, dimensional correction, or repair of a surface of a side of a notch of a component made of a material including titanium aluminide, the method including the method as recited in claim 44, wherein a workpiece zone in a region of a notch radius is not heated above a predetermined further critical temperature of the material, which is primarily dependent on the shape of the notch, and wherein a coil used for inductive heating of the workpiece and/or its position relative to the notch is/are adapted to the notch.
46. The method as recited in claim 45 wherein the coil is adapted to a shape of the notch.
47. The method as recited in claim 45 wherein the notch is an acute-angled notch.
48. The method as recited in claim 45 wherein the material consists of the titanium aluminide.
49. A method for hardfacing, dimensional correction, or repair of a functional surface of a Z-notch of a turbine blade tip shroud, a sealing fin on a turbine blisk, a tip shroud of a compressor rotor blade, or a housing part of a fluid flow machine, including the method as recited in claim 44.
50. A method for manufacturing a workpiece, the method comprising the steps of: preparing a substrate made of a material including a titanium aluminide; and

depositing at least one layer of an additive in accordance with the method as recited in claim 18 until a predetermined contour of the workpiece is formed or overfilled.

51. The method as recited in claim 50 wherein the material consists of the titanium aluminide.
52. The method as recited in claim 50 wherein the workpiece is a turbine or compressor blade or a turbine or compressor housing or a part thereof.
53. An apparatus for depositing layers of material on a workpiece by build-up welding, comprising: a holder for holding the workpiece;

a feeder for feeding an additive powder including a titanium aluminide;

a melter for melting the additive; and

a preheater for preheating the workpiece, the apparatus being configured and adapted to perform the method as recited in claim 18.
54. The apparatus as recited in claim 53 wherein the preheater is configured and adapted for localized inductive heating of a surface of the workpiece.
55. The apparatus as recited in claim 53 wherein the melter is adapted to produce a laser beam or a plasma jet and to direct the laser beam or plasma jet toward the workpiece.
56. A workpiece comprising at least one layer of material deposited in accordance with the method as recited in claim 18.

Wear-resistant layer for tial
DE102008056741

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- **International Patent Classification**
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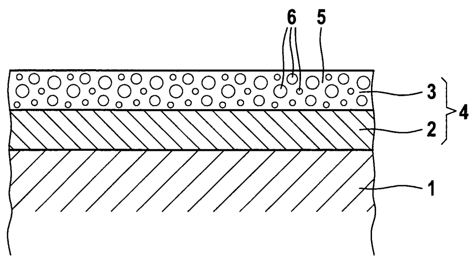
DE102008056741	A1	2010-05-12	[DE102008056741]
WO2010054633	A2	2010-05-20	[WO201054633]
WO2010054633	A3	2010-12-29	[WO201054633]

- **Abstract:**
  (WO201054633)
  The invention relates to a wear-resistant part for high-temperature applications made of a **TiAl** material, in particular a turbine blade comprising an at least double-layered protective coating (4). A first diffusion barrier layer (2) made of a precious metal and a second hard material layer (3) containing hard material particles that are embedded in a precious metal matrix are applied to the **TiAl** material (1) as a protective coating. The invention also relates to a corresponding production method.

Fig. 1



Claims
(WO201054633)

Claims machine translated from German
PATENT CLAIMS
1. wear-protected construction unit for applications of high temperatures from a TiAl material by an at least two-layered protective layer (4), by the fact marked that a first diffusion barrier layer (2) from a precious metal and a second hard material layer (3) with hard material particles, which are stored in a precious metal matrix, on the Ti AI-material (1) when protective layer is applied.
2. Construction unit according to requirement 1, by the fact characterized that the Ti Al - material .gamma.-Ti Al, Ct [2] - Ti [3] Al or an alloy on basis of these inter+metallic phases is.
3. Construction unit after one of the preceding requirements, by the fact characterized that the diffusion barrier layer (2) from platinum, palladium, osmium, silver, gold or alloys of it is.
4. Construction unit after one of the preceding requirements, by the fact characterized that the precious metal matrix of the hard material layer (3) by platinum, osmium, silver, gold or
Alloys of it is formed.
5. Construction unit after one of the preceding requirements, by the fact characterized that the hard material particles (6) of the hard material layer nanoskalige particles is.
6. Construction unit after one of the preceding requirements, by the fact characterized that the hard material particles exhibit less (6) of the hard material layer a middle or maximum grain size of 500 Nm or.
7. Construction unit after one of the preceding requirements, by the fact characterized that the hard material particles exhibit less (6) of the hard material layer a middle or maximum grain size of 250 Nm or.
8. Construction unit after one of the preceding requirements, by the fact characterized that the hard material particles of the hard material layer less exhibit a middle or maximum grain size of 100 Nm or.
9. Construction unit after one of the preceding requirements, by the fact characterized that the hard material particles of the hard material layer from a ceramic material are.
10. Construction unit after one of the preceding requirements, thereby characterized that the hard material particles of the hard material layer cover at least one component of the group, the alumina, zircon oxide, diamond, diamond-similar carbon, boron nitride, cubic boron nitride (CBN), titanium nitride, titanium aluminum nitride, silicon oxide and silicon carbide contains.
11. Construction unit after one of the preceding requirements, by the fact characterized that on the Ti AI-material excluding the two -layered protective layer (4) is arranged.
12. Construction unit after one of the preceding requirements, by the fact characterized that the diffusion barrier layer (2) on the Ti AI-material and/or the hard material layer (3) is directly arranged when layer is trained.
13. Construction unit after one of the preceding requirements, by the fact characterized that the diffusion barrier layer (2) a thickness of 0,5 .micro.m to 10 .micro.m and/or the hard material layer a thickness of 0,1 .micro.m to 100 .micro.m exhibits.
14. Construction unit after one of the preceding requirements, by the fact characterized that the hard material particles (6) itself over the surface expansion and/or the thickness of the hard material layer (3) in its size, chemical composition and/or its portion in the hard material layer differentiates.
15. Procedure for the production of an at least two-layered wear-protection layer (4) on a Ti aluminum material (1), characterized to that-to production a diffusion barrier layer (2) a precious metal it is separated and that for the training of a hard material layer (3) in a precious metal matrix stored hard material particle to be separated.
16. Procedure according to requirement 15, by the fact characterized that a construction unit is manufactured after one of the requirements 1 to 13.
17. Procedure after one of the requirements 15 to 16, by the fact characterized that for the production of the diffusion barrier layer an organic precious metal connection with or without solvents on the Ti aluminum material is applied.
18. Procedure after one of the requirements 15 to 17, by the fact characterized that for the production of the hard material layer an organic precious metal connection with or without solvents with dispersed hard material particles is applied.
19. Procedure after one of the requirements 15 to 18, by the fact characterized that for the production of the diffusion barrier layer and/or the hard material layer an organic precious metal connection with a solvent portion of 30% and more is applied.
20. Procedure after one of the requirements 15 to 19, by the fact characterized that the organic precious metal connection with or without solvents is applied and with or without hard material particles by means of laser technology.
21. Procedure after one of the requirements 15 to 20, by the fact characterized that the organic precious metal connection with or without solvents is submitted and with or without hard material particles of a temperature treatment, so that existing solvent is evaporated and/or the organic precious metal connection is decomposed.
22. Procedure after one of the requirements 15 to 21, by it characterized that the organic precious metal connection covers at least one element from the group, those
Pt, Pd, OS, RH, Ru, cu, AG, outer one, IR and Mo contain.
23. Procedure after one of the requirements 15 to 22, by the fact characterized that first the diffusion barrier layer and afterwards the hard material layer are applied.
24. Procedure according to requirement 21, by the fact characterized that the temperature treatment for the diffusion barrier layer and/or the hard material layer takes place successively separately or together.
25. Turbine blade from a TiAl material marked by an at least two-day protection layer, by the fact that a first diffusion barrier layer from a precious metal and a second hard material layer with hard material particles, which are stored in a precious metal matrix are covered by the protective layer on the TiAl material.
26. Turbine blade according to requirement 25, by the fact characterized that it is designed as construction unit after one of the requirements 1 to 13.
27. Turbine blade according to requirement 25 or 26, by it characterized that in the range of a sealing surface a hard material layer

is intended, by an organic precious metal connection also opposite the remaining protective layer smaller solvent content laid on is covered and/or opposite the remaining protective layer more and/or larger hard material particles.

TiaI-based alloy, process for production of the same, and rotor blade comprising the same

WO2009113335

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  2009WO-JP51539 2009-01-30

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WO2009113335	A1	2009-09-17	[WO2009113335]
JP2009215631	A	2009-09-24	[JP2009215631]
EP2251445	A1	2010-11-17	[EP2251445]
US2010316525	A1	2010-12-16	[US20100316525]
EP2251445	A4	2011-12-14	[EP2251445]

- **Abstract:**
  (EP2251445)
  A hot-forged **TiAl**-based alloy having excellent oxidation resistance and high strength at high temperatures, and a process for producing such an alloy. A **TiAl**-based alloy comprising Al: (40+a) atomic % and Nb: b atomic %, with the remainder being Ti and unavoidable impurities, wherein a and b satisfy formulas (1) and (2) below. (Equation image a01" not included in text) (Equation image a02" not included in text) Also, a **TiAl**-based alloy comprising Al: (40+a) atomic % and Nb: b atomic %, and further comprising one or more elements selected from the group consisting of V: c atomic %, Cr: d atomic % and Mo: e atomic %, with the remainder being Ti and unavoidable impurities, wherein a to e satisfy formulas (3) to (9) shown below. (Equation image a03" not included in text) (Equation image a04" not included in text) (Equation image a05" not included in text) (Equation image a06" not included in text) (Equation image a07" not included in text) (Equation image a08" not included in text) (Equation image a09" not included in text)

$$b \geq 2 \quad (5)$$

Claims

(EP2251445)

1. A TiAl-based alloy comprising
Al: (40+a) atomic % and
Nb: b atomic %,
with a remainder being Ti and unavoidable impurities,
wherein
a and b satisfy formulas (1) and (2) below: (Equation image 31 not included in text)
and (Equation image 32 not included in text)
2. A TiAl-based alloy comprising
Al: (40+a) atomic % and
Nb: b atomic. %, and further comprising
one or more elements selected from the group consisting of
V: c atomic %,
Cr: d atomic % and
Mo: e atomic %,
with a remainder being Ti and unavoidable impurities,
wherein
a to e satisfy formulas (3) to (9) shown below: (Equation image 33 not included in text) (Equation image 34 not included in text) (Equation image 35 not included in text) (Equation image 36 not included in text) (Equation image 37 not included in text) (Equation image 38 not included in text)
and (Equation image 39 not included in text)
3. The TiAl-based alloy according to claim 1 or 2, having a metal structure comprising aligned lamellar grains in which an alpha 2-phase and a gamma -phase are stacked in an alternating manner.
4. A process for producing a TiAl-based alloy, the process comprising: holding a TiAl-based alloy material, comprising
Al: (40+a) atomic % and
Nb: b atomic %,
with a remainder being Ti and unavoidable impurities, wherein a and b satisfy formulas (1) and (2) below: (Equation image 40 not included in text)
and (Equation image 41 not included in text) at a holding temperature within an equilibrium temperature range for an (alpha +beta) phase, and subjecting the TiAl-based alloy material held at the holding temperature to high-speed plastic working while cooling to a predetermined final working temperature.
5. A process for producing a TiAl-based alloy, the process comprising: holding a TiAl-based alloy material, comprising
Al: (40+a) atomic % and
Nb: b atomic %, and further comprising
one or more elements selected from the group consisting of
V: c atomic %,
Cr: d atomic % and
Mo: e atomic %,
with a remainder being Ti and unavoidable impurities, wherein a to e satisfy formulas (3) to (9) shown below: (Equation image 42 not included in text) (Equation image 43 not included in text) (Equation image 44 not included in text) (Equation image 45 not included in text) (Equation image 46 not included in text) (Equation image 47 not included in text)
and (Equation image 48 not included in text) at a holding temperature within an equilibrium temperature range for an (alpha +beta) phase, and subjecting the TiAl-based alloy material held at the holding temperature to high-speed plastic working while cooling to a predetermined final working temperature.
6. The process for producing a TiAl-based alloy according to claim 4 or claim 5, wherein
the holding temperature is not less than 1150 deg.C and not more than 1350 deg.C.
7. A process for producing a TiAl-based alloy according to any one of claim 4 to claim 6, wherein
the final working temperature is not less than 1150 deg.C.
8. A process for producing a TiAl-based alloy according to any one of claim 4 to claim 7, wherein
a forging process is used for the high-speed plastic working.
9. A rotor blade that uses the TiAl-based alloy according to any one of claim 1 to claim 3.

$g(G)- TIAL ALLOY-BASED COMPONENT COMPRISING AREAS HAVING A GRADUATED STRUCTURE

WO200188214

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- **International Patent Classification**
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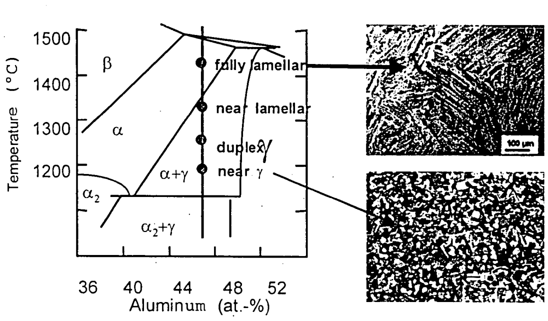
  2001WO-EP05621 2001-05-17

- **Fampat family**

WO200188214	A1	2001-11-22	[WO200188214]
DE10024343	A1	2001-11-22	[DE10024343]
AU6229501	A	2001-11-26	[AU200162295]
EP1287173	A1	2003-03-05	[EP1287173]
JP2003533594	A	2003-11-11	[JP2003533594]
US2004045644	A1	2004-03-11	[US20040045644]
EP1287173	B1	2008-01-16	[EP1287173]
AT384146	T	2008-02-15	[ATE384146]
DE50113507	D1	2008-03-06	[DE50113507]
ES2298238	T3	2008-05-16	[ES2298238]

- **Abstract:**

(EP1287173)
The invention relates to a component produced in one piece from an intermetallic gamma-TiAl-based alloy with graduated microstructure transition between spatially adjacent areas each of different microstructure structure, which has a lamellar cast microstructure composed of alpha2/gamma lamellae in at least one area, and a near-gamma microstructure, duplex microstructure or fine-lamellar microstructure in at least one other area, and a transition zone with graduated microstructure, in which the lamellar cast microstructure gradually changes into the other named microstructure, is present between these areas, as well as to a process for its production. (From US2004045644 A1)



Claims

(EP1287173)

1. Component produced in one piece from an intermetallic gamma -TiAl-based alloy with graduated microstructure transition between spatially adjacent areas each of different microstructure structure, characterized in that it has a lamellar cast microstructure composed of alpha 2/gamma lamellae in at least one area, which has been produced by oriented solidification of a melted alloy, and a near-gamma microstructure produced by massive metal-forming, duplex microstructure or fine-lamellar microstructure in at least one other area, and a transition zone with graduated microstructure, in which the lamellar cast microstructure gradually changes into the other named microstructure, is present between these areas.
2. Component according to claim 1, characterized in that the near-gamma microstructure, duplex microstructure or fine-lamellar microstructure has been produced from the cast microstructure in the at least one other area by massive metal-forming and a post -treatment.
3. Component according to claim 1 or 2, characterized in that it is a cylindrical semi-finished product, obtained pore-free in bar shape from the melt by means of continuous casting, which is massively metal-formed by extrusion of a bar area.
4. Component according to claim 1 or 2, characterized in that it is a cylindrical semi-finished product obtained cavity-free from the melt by means of centrifugal casting, which is then massively metal-formed by extrusion of a bar area.
5. Component according to at least one of claims 1 to 4, characterized in that the alloy corresponds to the empirical formula

Ti Al (44-48) (Cr, Mn, V) 0.5-5 (Zr, Cu, Nb, Ta, Mo, W, Ni) 0.1-10 (Si, B, C, Y) 0.05-1

expressed in atom-%.
6. Component according to at least one of claims 1 to 5, characterized in that it is a valve for combustion engines.
7. Process for the production of components according to claim 1, characterized in that a suitable Ti-Al melt is produced in customary manner in a first step, the TiAl melt is converted by oriented solidification in a second step to a semi-finished product which has a lamellar cast microstructure composed of alpha 2/gamma -TiAl lamellae, and, in a part area or in part areas of the semi-finished product, the lamellar cast microstructure composed of alpha 2/gamma - TiAl lamellae is converted by massive metal -forming in a third step in a temperature range of 900 deg.C to 1400 deg.C to a near-gamma microstructure, duplex microstructure or fine-lamellar microstructure.
8. Process according to claim 7, characterized in that a pore-free, cylindrical semi-finished product is produced from the TiA1 melt by means of continuous casting, and is then massively metal-formed by extrusion of a bar area.
9. Process according to claim 7, characterized in that a cylindrical semi-finished product is produced cavity-free from the TiAl melt by means of centrifugal casting, and is then massively metal-formed by extrusion of a bar area.
10. Process according to at least one of claims 7 to 9, characterized in that the TiAl alloy corresponds to the empirical formula:

Ti Al (44-48) (Cr, Mn, V) 0,5-5 (Zr, Cu, Nb, Ta, Mo, W, Ni) 0.1-10 (Si, B, C, Y) 0.05-1

expressed in atom-%.
11. Process according to at least one of claims 7 to 10, characterized in that a valve for combustion engines is produced.

Process for producing a TiAl-based alloy poppet valve AT---2881U

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- **International Patent Classification**
  B21C-023/14 B21K-001/22 B23P-015/00 C22C-014/00 F01L-003/02 F01L-003/24
- **US Patent Classification**
  PCLO=029888451 PCLX=029888453
- **CPC Code**
  B21C-023/22; B21C-033/00/4; B21K-001/22; B23P-015/00/2; C22C-014/00; C22F-001/18/3; F01L-003/02
- **Publication Information**
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- **Priority Details**
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- **Fampat family**

AT2881	U1	1999-06-25	[AT---2881U]
EP0965412	A1	1999-12-22	[EP-965412]
KR20000005995	A	2000-01-25	[KR20000005995]
JP2000024748	A	2000-01-25	[JP2000024748]
BR9902705	A	2000-02-22	[BR9902705]
US6161285	A	2000-12-19	[US6161285]
EP0965412	B1	2002-05-08	[EP-965412]
DE59901376	D1	2002-06-13	[DE59901376]
ES2175896	T3	2002-11-16	[ES2175896]
KR100544955	B1	2006-01-24	[KR100544955]
JP4368455	B2	2009-11-18	[JP4368455]

- **Abstract:**
  (EP-965412)
  One-piece i.c. engine disc valve of gamma titanium-aluminum alloy A gamma -TiAl alloy disc valve is produced by partial extrusion of a preform, having the requisite disc diameter (D) and properties, using a die with a taper (4) corresponding to the valve cone (1). A gamma -TiAl alloy disc valve is produced by: (i) primary deformation to produce a valve preform having the diameter (D) and the requisite material properties of the valve disc; and (ii) secondary deformation by extrusion using a die having an entry opening (6) of diameter corresponding to that of the preform and an identical diameter cylindrical section (3) merging, by means of a taper (4) corresponding to the valve cone (1), into an exit opening (5) of diameter (d) corresponding to that of the valve stem (2), the extrusion operation being terminated when the desired valve disc thickness (S) is achieved. Preferred Features: The gamma -TiAl alloy has the composition 46.5 at. % Al, 2.5 at. % Cr, 1 at. % Nb, 0.5 at. % B and balance Ti.

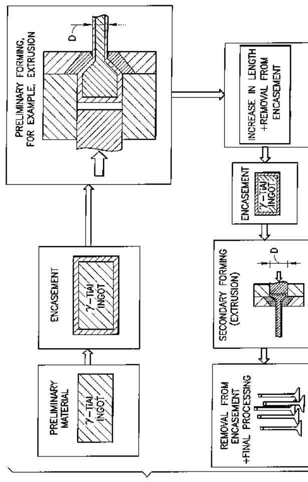

FIG.1

Claims
(EP-965412)

1. Process for the production of a poppet valve from gamma -TiAl-based alloys for internal combustion engines, said valve comprising the valve sections cylindrical head of thickness S, cone (1) and stem (2), in the form of an at least near-net-shape valve by primary forming of a homogeneous blank and subsequent secondary forming,
characterised in that
primary forming is performed at temperatures in the range from 1000 to 1350 DEG.C and at forming ratios in the range from 5-50:1 in such a manner that, thereafter, the gamma -TiAl blank exhibits approximately the diameter D of the valve head and the material properties required for the valve head, and the secondary forming of the primarily formed blank proceeds by extrusion using an extrusion die which is of a form such that the diameter of the inlet orifice (6) approximately corresponds to that of the primarily formed blank, and a cylindrical section (3) corresponding to this diameter develops via a taper (4) approximately corresponding to the valve cone into the outlet orifice (5), which at least approximately corresponds to the diameter d of the valve stem (2) and that the extrusion operation is terminated once the thickness S of the valve head is achieved.
2. Process for the production of a poppet valve according to claim 1, characterised in that primary forming proceeds by extrusion at temperatures in the range from 1000 to 1350 DEG.C, at strain rates in the range from 10**-3 -1/s and forming ratios in the range up to 50:1.
3. Process for the production of a poppet valve according to claim 1 or 2, characterised in that secondary forming proceeds at temperatures in the range from 1000-1420 DEG.C, at strain rates in the range from 10**-2 -10**2 /s and forming ratios in the range from 5-80:1, relative to the primarily formed blank.
4. Process for the production of a poppet valve according to one of claims 2 to 3, characterised in that the starting material is canned in a protective jacket before the primary and secondary forming.
5. Process for the production of a poppet valve according to claim 4, characterised in that steel is used as the material for the canning material and a diffusion barrier in the form of a molybdenum layer is provided between the canning material and the gamma -TiAl material.
6. Process for the production of a poppet valve according to one of claims 2 to 5, characterised in that a molybdenum alloy is used as the material for the extrusion die.
7. Process for the production of a poppet valve according to one of claims 1 to 6, characterised in that an alloy with the composition 46.5 atom% Al, 2.5 atom% Cr, 1 atom% Nb, 0.5 atom% Ta, 0.1 atom% B, remainder Ti is used as the gamma -TiAl alloy.

Titanium aluminide application process and article with titanium aluminide surface

EP2584056

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- **International Patent Classification**
  B05D-001/02 B05D-003/00 B05D-003/02 B05D-003/12 B05D-007/24 C22C-014/00 C22C-021/00 C23C-004/06 C23C-024/04 C23C-028/00 F01D-005/00 F01D-025/00
- **US Patent Classification**
  PCLO=427421100 PCLX=420418000 PCLX=420552000
- **CPC Code**
  C22C-014/00; C23C-024/04; F01D-005/00/5; F01D-025/00; F05D-2230/80
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- **Priority Details**
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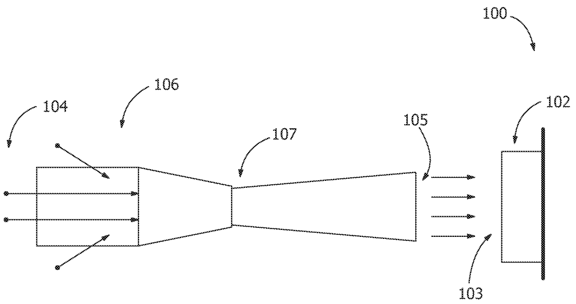
- **Fampat family**

EP2584056	A1	2013-04-24	[EP2584056]
US2013101459	A1	2013-04-25	[US20130101459]
JP2013087364	A	2013-05-13	[JP2013087364]
US8475882	B2	2013-07-02	[US8475882]
RU2012145763	A	2014-04-27	[RU2012145763]

- **Abstract:**
  (EP2584056)
  A titanium aluminide application process and article with a titanium aluminide surface are disclosed. The process includes cold spraying titanium aluminide onto an article within a treatment region to form a titanium aluminide surface. The titanium aluminide surface includes a refined gamma/alpha2 structure and/or the titanium aluminide is cold sprayed from a solid feedstock of a pre-alloyed powder.



Claims

(EP2584056)

1. A titanium aluminide application process, comprising: cold spraying titanium aluminide onto an article within a treatment region to form a titanium aluminide surface; wherein the titanium aluminide surface includes a refined gamma/alpha2 structure.
2. The process of claim 1, wherein the titanium aluminide surface includes little or no equiaxed grains.
3. The process of claim 1 or claim 2, wherein the article is a turbine component.
4. The process of any preceding claim, wherein the titanium aluminide cold sprayed onto the article has a composition including, by weight, including about 45% titanium and about 50% aluminum.
5. The process of any preceding claim, wherein the titanium aluminide cold sprayed onto the article has a composition including Al 2Ti.
6. The process of any preceding claim, wherein the titanium aluminide cold sprayed onto the article has a composition including Al 3Ti.
7. The process of any preceding claim, wherein the cold spraying of titanium aluminide includes accelerating a solid feedstock with a converging-diverging nozzle.
8. The process of any preceding claim, wherein the titanium aluminide surface is directly on a substrate of the article.
9. The process of any preceding claim, wherein the titanium aluminide surface is on a bond coat on the article.
10. The process of any preceding claim, further comprising shot peening of the titanium aluminide surface.
11. The process of any preceding claim, further comprising heat treating the titanium aluminide surface.
12. The process of any preceding claim, further comprising finishing the titanium aluminide surface.
13. The process of any preceding claim, further comprising identifying a repair region within the treatment region prior to cold spraying the titanium aluminide.
14. The process of any preceding claim, further comprising removing material from the treatment region prior to cold spraying the titanium aluminide.
15. The process of claim 14, wherein the removing of the material includes a first sub-step of removal for identifying the repair region and a second sub-step for opening up the repair region.
16. The process of any preceding claim, further comprising cleaning within the treatment region prior to cold spraying the titanium aluminide.
17. The process of any preceding claim, wherein the solid feedstock is a pre-alloyed powder.
18. The process of any preceding claim, wherein the cold spraying of the titanium aluminide is part of a repair process.
19. A titanium aluminide application process of any preceding claim, comprising: cold spraying titanium aluminide onto an article within a treatment region to form a titanium aluminide surface; wherein the titanium aluminide cold sprayed is from a solid feedstock of a pre-alloyed powder.
20. An article, comprising a titanium aluminide surface, the titanium aluminide surface including a refined gamma/alpha2 structure.

Method for protecting the surface of an intermetallic alloy substrate with a titanium- aluminide base against corrosion

EP2014460

- **Patent Assignee**
  ONERA - OFFICE NATIONAL D'ETUDES & DE RECHERCHES AEROSPATIALES

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- **International Patent Classification**
  B32B-015/01 C22C-014/00 C22C-021/00 C23C-010/28 C23C-014/16 C23C-014/34 C25D-003/48 C25D-005/02 C25D-005/50 C25D-007/00 C25D-009/00 C25D-011/00 F01D-005/28

- **US Patent Classification**
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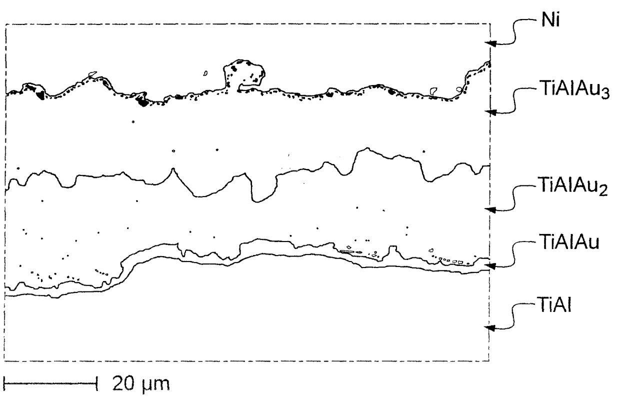
EP2014460	A2	2009-01-14	[EP2014460]
US2009017329	A1	2009-01-15	[US20090017329]
FR2918672	A1	2009-01-16	[FR2918672]
JP2009013500	A	2009-01-22	[JP2009013500]
EP2014460	A3	2009-02-18	[EP2014460]
FR2918672	B1	2009-10-09	[FR2918672]
EP2014460	B1	2010-02-17	[EP2014460]
DE602008000652	D1	2010-04-01	[DE602008000652]
US8617323	B2	2013-12-31	[US8617323]
JP5645353	B2	2014-12-24	[JP5645353]

- **Abstract:**
  (EP2014460)
  The process for protecting a surface of a substrate made of an intermetallic alloy against corrosion, comprises preparing the substrate, electrolytically depositing a gold coating on the surface of the substrate with a part of bath of gold plating, and annealing the coated substrate in controlled conditions for provoking a limited diffusion of the gold in the surface. The preparation of the substrate includes pre-treating the substrate surface by sanding, treating the surface by acid attack, and rinsing the surface. The gold coating has a thickness of 20-40 mu m. The process for protecting a surface of a substrate made of an intermetallic alloy against corrosion, comprises preparing the substrate, electrolytically depositing a gold coating on the surface of the substrate with a part of bath of gold plating, and annealing the coated substrate in controlled conditions for provoking a limited diffusion of the gold in the surface. The prepara tion of the substrate includes pre-treating the substrate surface by sanding, treating the surface by acid attack, and rinsing the surface. The gold coating has a thickness of 20-40 mu m. The annealing is carried out at high temperature of 900[deg] C and reduced pressure of 10 -> 3> Pa to form a phase of **titanium aluminide** trigold, **titanium aluminide** digold and **titanium aluminide** monogold. An additional coating of other material is deposited on the gold coating to form an underlayer that protects against the corrosion. An additional annealing step is included for regenerating the gold coating in



case of halogenous corrosion. The halogenous corrosion results in depletion of volatile halogens. An independent claim is included for a part comprising a substrate made of an intermetallic alloy.

Claims

(EP2014460)

1. Process for protecting the surface of a substrate of intermetallic alloy with a base of titanium aluminide against corrosion, characterised in that it comprises the following operations: a) prepare a substrate formed of the said intermetallic alloy; b) deposit a coating of gold on the surface of the substrate to be protected; c) subject the substrate so equipped with the gold coating to annealing in controlled conditions in order to bring about limited diffusion of the gold into the surface to be protected.
2. Process according to claim 1, characterised in that the intermetallic alloy is selected from alloys with a base of gamma -TiAl and alloys with a base of alpha 2-Ti 3Al.
3. Process according to either of claims 1 or 2, characterised in that the operation of preparation a) comprises pre-treatment of the surface to be protected by sand-blasting, then treatment by at least one acid etching stage followed by rinsing.
4. Process according to anyone of claims 1 to 3, characterised in that the operation of deposition b) is carried out electrolytically with a gilding bath.
5. Process according to claim 4, characterised in that the gilding bath comprises a solution of sodium sulphite containing metallic gold.
6. Process according to anyone of claims 1 to 5, characterised in that the deposition operation b) is carried out in conditions such that the gold coating has a thickness of at least 2.5 micron m, preferably of between 20 and 40 micron m.
7. Process according to anyone of claims 1 to 6, characterised in that the annealing operation c) is carried out at high temperature and under reduced pressure to form the phases TiAlAu 3, TiAlAu 2 and TiAlAu.
8. Process according to claim 7, characterised in that the annealing operation c) is carried out at a temperature of between 850 and 1050 deg.C, preferably about 900 deg.C and under a vacuum of better than 10 **-3 Pa.
9. Process according to either of claims 7 or 8, characterised in that the annealing operation c) is carried out under a vacuum of better than 10 **-3 Pa.
10. Process according to one of claims 1 to 9, characterised in that it comprises a supplementary operation consisting in: d) depositing on the gold coating forming an underlayer an additional coating of another material to act as protection against erosion.
11. Process according to claim 10, characterised in that this other material is a metal such as pure gold or another metal not forming oxides nor sulphides nor halides, such as platinum, palladium, osmium, rhodium, iridium and ruthenium.
12. Process according to claim 10, characterised in that this other material is a ceramic with a base of oxides, carbides, or nitrides.
13. Process according to anyone of claims 1 to 12, characterised in that it comprises a further operation consisting of carrying out a repeated anneal under vacuum in order to regenerate the gold coating in the case of halogenated corrosion.
14. Process according to claim 13, characterised in that the halogenated corrosion is manifested by depletion by elimination of the volatile halides such as AlCl 3 or AlF 3, TiCl 4 or TiF 4.
15. Part comprising a substrate of intermetallic alloy with a base of titanium aluminide one surface of which was protected against corrosion by a process according to anyone of claims 1 to 14.
16. Part according to claim 15, intended for a gas turbine, in particular an aircraft engine.

Bonding of a titanium aluminide turbine rotor to a steel shaft
EP1507062

- **Patent Assignee**
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- **International Patent Classification**
  B22F-003/02 B22F-005/04 B22F-007/00 B22F-007/06 B22F-007/08 C22C-014/00 C22C-038/00 C22C-038/48 F01D-005/02 F01D-005/04 F01D-025/00 F02B-039/00
- **US Patent Classification**
  PCLO=416213000R PCLX=416244000A PCLX=419008000 PCLX=428553000
- **CPC Code**
  B22F-005/04; B22F-007/06/2; B22F-007/08; F01D-005/02/5; F01D-005/02; F05D-2220/40; F05D-2230/22; F05D-2300/173; Y10T-428/12063
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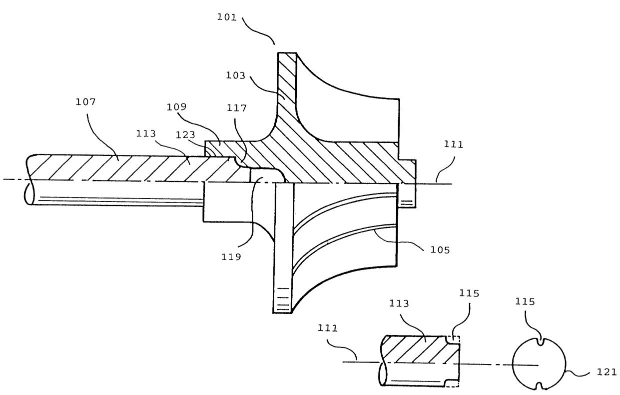
- **Fampat family**

EP1507062	A2	2005-02-16	[EP1507062]
US2005036893	A1	2005-02-17	[US20050036893]
JP2005060829	A	2005-03-10	[JP2005060829]
US7052241	B2	2006-05-30	[US7052241]
EP1507062	A3	2007-03-28	[EP1507062]
EP1507062	B1	2008-01-09	[EP1507062]
DE602004011156	D1	2008-02-21	[DE602004011156]
DE602004011156	T2	2008-12-24	[DE602004011156]
JP4698979	B2	2011-06-08	[JP4698979]

- **Abstract:**
  (EP1507062)
  A rotor shaft assembly (101) of a type used in a turbocharger, manufactured by mounting a powder compact (203) of a titanium aluminide rotor (103) to a pre-formed steel shaft (107), and sintering the combination, which provides a strong metallurgical bond between the shaft (107) and rotor (103). There is provided a rotor shaft assembly (101) and an inexpensive and efficient method of its manufacture, for an assembly capable of withstanding the high forces and fluctuating temperatures within a turbocharger.



Claims

(EP1507062)

1. A process for axially bonding the hub (109) of a titanium aluminide (TiAl) turbine rotor (103) to a pre-formed steel shaft (107) of a rotor shaft assembly (101) of a type used in a turbocharger for rotating about its axis (111) to drive a compressor, said process comprising:
(a) axially mounting a preformed steel shaft (107), to the hub (209) of a compact (203) of said rotor (103), wherein said compact comprises a TiAl powder admixed with a binder, to form a mounted compact (201) optionally comprising a clearance (211) between said hub (209) of said compact (203) and said shaft (107), and
(b) debinding and sintering said mounted compact (201), wherein said rotor compact (203) and said clearance (211) are selected to provide a tight fit of said hub (209) to said shaft (107) during sintering, whereby said rotor (103) and said shaft (107) are bonded to form said rotor shaft assembly (101).
2. The process of claim 1, wherein said sintering is performed from about 1200 DEG.C to about 1430 DEG.C for a period from about 45 min to about 2 hours.
3. The process of claim 1, wherein said powders have a particle size of from about 1 m to 40 m.
4. The process of claim 3, wherein said powders have a particle size of from about 1 m to 10 m.
5. The process of claim 1, wherein said binder is selected from the group consisting of waxes, polyolefin, polyethylene, polypropylene, polystyrene, polyvinyl chloride, polyethylene carbonate, polyethylene glycol, and microcrystalline wax, or a mixture thereof.
6. The process of claim 1, wherein said debinding is carried out at temperature of between about 200 DEG.C and 250 DEG.C.
7. A rotor shaft assembly (101) prepared according to the process of claim 1.
8. The rotor shaft assembly (101) of claim 7, in which said shaft (107) comprises stainless steel.
9. The rotor shaft assembly (101) of claim 7, in which the proximal end of said shaft (107) has a shape selected from the group consisting of a knurled shaft (301), a polygonal shaft (305), a flatted shaft (309), a threaded shaft (313), and a notched shaft (107).
10. The rotor shaft assembly (101) of claim 7, further comprising one or more cavities (119) disposed between the proximal end (113) of said shaft (107) and said hub (109).

Method of friction-welding a shaft to a titanium aluminide turbine rotor
EP-816007

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- **International Patent Classification**
  B23K-020/12 B23K-020/227 B23K-103/24 F01D-005/02 F01D-005/04
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  1996JP-0164282 1996-06-25

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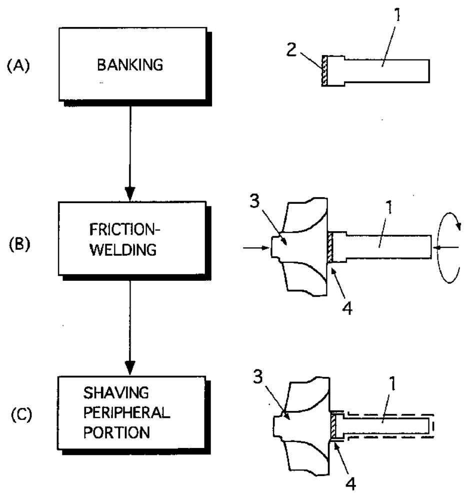
EP0816007	A2	1998-01-07	[EP-816007]
JPH106042	A	1998-01-13	[JP10006042]
EP0816007	A3	1998-01-28	[EP-816007]
EP0816007	B1	2003-01-29	[EP-816007]
DE69718713	D1	2003-03-06	[DE69718713]
DE69718713	T2	2003-07-03	[DE69718713]

- **Abstract:**
  (EP-816007)
  There is provided a method of friction-welding a steel shaft to a turbine rotor made of titanium aluminide, including the steps of (a) banking a heat resistant alloy onto an end surface of the shaft, (b) rotating the turbine rotor and the shaft relative to each other at a peripheral speed in the range of about 145 cm/s to about 260 cm/s both inclusive with the heat resistant alloy being compressed onto a surface of the turbine rotor, to thereby pressure-welding the shaft to the turbine rotor due to frictional heat generated by relative rotation between the shaft and the turbine rotor, and (c) shaving a peripheral portion of the shaft so that the shaft has an outer diameter which is about 80% of an original diameter thereof. The method enables to bond a turbine rotor made of titanium aluminide to a steel shaft with sufficient bonding strength without causing cracks on surfaces of the turbine rotor and shaft.

FIG. 1



Claims

(EP-816007)

1. A method of friction-welding a steel shaft to a turbine rotor made of titanium aluminide, comprising the steps of:
(a) banking a heat resistant alloy onto an end surface of said shaft;

(b) rotating said turbine rotor and said shaft relative to each other at a peripheral speed in the range of about 145 cm/s to about 260 cm/s both inclusive with said heat resistant alloy being compressed onto a surface of said turbine rotor, to thereby pressure-welding said shaft to said turbine rotor due to frictional heat generated by relative rotation between said shaft and said turbine rotor;
and
(c) shaving a peripheral portion of said shaft.
2. The method as set forth in claim 1, wherein cracked portions are shaved off in said step (c).
3. The method as set forth in claim 1, wherein said heat resistant alloy has high binding force both to said shaft and said turbine rotor.
4. The method as set forth in claim 1 further comprising the step (d) of forming at least one hole with said heat resistant alloy, said step (d) being carried out between said steps (a) and (b).
5. The method as set forth in claim 1, wherein said heat resistant alloy is selected from a group consisting of nickel-based alloy, austenite family iron-based alloy, titanium-based alloy and cobalt-based alloy.
6. The method as set forth in claim 1, wherein said heat resistant alloy is compressed onto said turbine rotor in said step (b) under a pressure of about 30 kgf/mm**2 when frictional heat generates and about 40 kgf/mm**2 when said shaft is bonded to said turbine rotor.
7. The method as set forth in claim 1, wherein only said shaft is rotated in said step (b).
8. The method as set forth in claim 1, wherein said shaft is made of one of low alloy steel and common steel.
9. A method of friction-welding a steel shaft to a turbine rotor made of titanium aluminide, comprising the steps of:
(a) banking a heat resistant alloy onto an end surface of said shaft;

(b) rotating said turbine rotor and said shaft relative to each other at a peripheral speed in the range of about 145 cm/s to about 260 cm/s both inclusive with said heat resistant alloy being compressed onto a surface of said turbine rotor, to thereby pressure-welding said shaft to said turbine rotor due to frictional heat generated by relative rotation between said shaft and said turbine rotor;
and
(c) shaving a peripheral portion of said shaft so that said shaft has an outer diameter which is about 80% of an original diameter thereof.
10. The method as set forth in claim 9, wherein said heat resistant alloy has high binding force both to said shaft and said turbine rotor.
11. The method as set forth in claim 9 further comprising the step (d) of forming at least one hole with said heat resistant alloy, said step (d) being carried out between said steps (a) and (b).
12. The method as set forth in claim 9, wherein said heat resistant alloy is selected from a group consisting of nickel-based alloy, austenite family iron-based alloy, titanium-based alloy and cobalt-based alloy.
13. The method as set forth in claim 9, wherein said heat resistant alloy is compressed onto said turbine rotor in said step (b) under a pressure of about 30 kgf/mm**2 when frictional heat generates and about 40 kgf/mm**2 when said shaft is bonded to said turbine rotor.
14. The method as set forth in claim 9, wherein only said shaft is rotated in said step (b).
15. The method as set forth in claim 9, wherein said shaft is made of one of low alloy steel and common steel.

Titanium aluminide alloys
CA2645843

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EP2075349	A2	2009-07-01	[EP2075349]
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EP2075349	A3	2009-09-09	[EP2075349]
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EP2423341	A1	2012-02-29	[EP2423341]
RU2466201	C2	2012-11-10	[RU2466201]
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EP2423341	B1	2013-07-10	[EP2423341]
CN101457314	B	2013-07-24	[CN101457314B]
EP2145967	B1	2013-07-24	[EP2145967]
JP5512964	B2	2014-06-04	[JP5512964]
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- **Abstract:**
  (EP2423341)
  Alloy based on titanium aluminides has the composition: Ti - (38 -42 at.%) Al - (5-10 at.%) Nb. The composition has composite lamellae structures with B19-phase and beta -phase in each lamella. The ratio, especially the volume ratio, of the B19-phase and the beta -phase in each lamella is 0.05-20, especially 0.1-10. Independent claims are also included for the following: (1) Method for the production of the alloy; and (2) Component made from the alloy.

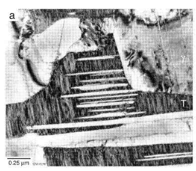

Fig. 1a

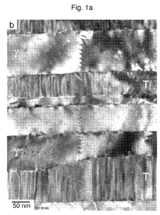

Fig. 1b

Claims

(EP2423341)

1. An alloy based on titanium aluminides, particularly made with the use of fusion or powder metallurgical processes, preferably on the basis of gamma (**TiAl**), wherein **TiAl** alloys with further additives contain volumetric fractions of the beta phase, characterised in that the composition includes composite lamellar structures with B19 phase and beta phase in each lamella, wherein the ratio, particularly the volumetric ratio, of the B19 phase and the beta phase in each lamella is between 0.05 and 20, particularly between 0.1 and 10, wherein the alloy has the following composition: Ti - (41 to 44.5 at %) Al - (5 to 10 at %) Nb - (0.5 to 5 at %) Fe.
2. An alloy as claimed in claim 1, characterised in that the ratio, particularly the volumetric ratio, of the B19 phase and the beta phase in each lamella is between 0.2 and 5, particularly between 0.25 and 4.
3. An alloy as claimed in claim 1 or 2, characterised in that the ratio, particularly the volumetric ratio, of the B19 phase and beta phase in each lamella is between (1/3) and 3, particularly between 0.5 and 2.
4. An alloy as claimed in one of claims 1 to 3, characterised in that the ratio, particularly the volumetric ratio, of the B19 phase and beta phase in each lamella is between 0.75 and 1.25, particularly between 0.8 and 1.2, preferably between 0.9 and 1.1.
5. An alloy as claimed in one of claims 1 to 4, characterised in that the composition selectively includes (0.1 to 1 to 1 at %) B (boron) and/or (0.1 to 1 at %) C (carbon).
6. An alloy as claimed in one of claims 1 to 5, characterised in that lamellas of the composite lamellar structures are surrounded by lamellas of the gamma (**TiAl**) type, preferably on both sides of the lamella.
7. An alloy as claimed in one of claims 1 to 6, characterised in that the lamellas of the composite lamellar structures have a volumetric proportion of more than 10%, preferably more than 20%, of the alloy.
8. An alloy as claimed in one of claims 1 to 7, characterised in that the lamellas of the composite lamellar structures include the phase alpha 2-Ti 3Al in a proportion of up to 20%.
9. A method of making an alloy as claimed in one claims 1 to 8 using fusion or powder metallurgical techniques, wherein after making the alloy into an intermediate product a further heat treatment of the intermediate product is performed at temperatures above 900 deg.c, preferably above 1000 deg.c, particularly at temperatures between 1000 deg.c and 1200 deg.c for a predetermined period of time of more than 60 minutes, preferably more than 90 minutes and subsequently the heat-treated alloy is cooled at a predetermined cooling rate of more than 0.5 deg.C per minute.
10. A method as claimed in claim 9, characterised in that heat-treated alloy is cooled at a predetermined cooling rate of between 1 deg.c per minute to 20 deg.c per minute, preferably to 10 deg.c per minute.
11. A component which is made of an alloy as claimed in one of claims 1 to 8, wherein, in particular, the alloy is made by fusion or powder metallurgical methods or techniques.
12. Use of an alloy as claimed in one of claims 1 to 8 for making a component.

TiAl blade with surface modification
EP2808488

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DE102013209994	A1	2014-12-04	[DE102013209994]

- **Abstract:**
  (US20140356644)
  A component for a turbomachine having at least one region made of an intermetallic material which is formed from an intermetallic compound or comprises an intermetallic phase as the largest constituent. The intermetallic material is compacted and/or modified in microstructure by microplasticization at least partially at a surface or interface in a region close to the surface or interface. (From US2014356644 A1)