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US6214133	Two phase titanium aluminide alloy PHILIP MORRIS
WO9951787	Two phase titanium aluminide alloy CHRYSALIS TECHNOLOGIES CHRYSALIS TECHNOLOGY PHILIP MORRIS
WO200233138	Creep resistant titanium aluminide alloys CHRYSALIS TECHNOLOGIES CHRYSALIS TECHNOLOGY PHILIP MORRIS

Two phase titanium aluminide alloy
US6214133

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- **International Patent Classification**
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- **Fampat family**

US6214133	B1	2001-04-10	[US6214133]

- **Abstract:**
  (US6214133)
  A two-phase titanic aluminide alloy having a lamellar microstructure with little intercolony structures. The alloy can include fine particles such as boride particles at colony boundaries and/or grain boundary equiaxed structures. The alloy can include alloying additions such as <=10 at % W, Nb and/or Mo. The alloy can be free of Cr, V, Mn, Cu and/or Ni and can include, in atomic %, 45 to 55% Ti, 40 to 50% Al, 1 to 5% Nb, 0.3 to 2% W, up to 1% Mo and 0.1 to 0.3% B. In weight %, the alloy can include 57 to 60% Ti, 30 to 32% Al, 4 to 9% Nb, up to 2% Mo, 2 to 8% W and 0.02 to 0.08% B.

Claims

(US6214133)

What is claimed is:

1.

A two phase Cr-free and Mu-free titanium aluminide alloy consisting essentially of, in weight %, 50 to 65% Ti, 25 to 35% Al, 2 to 15% Nb, less than 5% Mo, 1 to 10% W, and 0.01 to 0.2% B.

2. The titanium aluminide alloy of claim 1, in an as-cast, hot extruded, cold worked, or heat treated condition.

3. The titanium aluminide alloy of claim 1, wherein the alloy has a two-phase lamellar microstructure with fine particles are located at colony boundaries.

4. The titanium aluminide alloy of claim 3, wherein fine boride particles are located at the colony boundaries.

5. The titanium aluminide alloy of claim 3, wherein fine second-phase particles are located at the colony boundaries.

6. The titanium aluminide alloy of claim 1, wherein the alloy has a two-phase microstructure including grain-boundary equiaxed structures.

7. The titanium aluminide alloy of claim 1, wherein the Ti content is 57 to 60%, the Al content is 30 to 32%, the Nb content is 4 to 9%, the Mo content is at most 2%, the W content is 2 to 8% and the B content is 0.02 to 0.08%.

8. The titanium aluminide alloy of claim 1, having a yield strength of more than 80 ksi (560 MPa), an ultimate tensile strength of more than 90 ksi (680 MPa) and/or tensile elongation of at least 1%.

9. The titanium aluminide alloy of claim 1, wherein the alloy has a microstructure in which W is distributed non-uniformly.

10. The titanium aluminide alloy of claim 1, wherein aluminum is present in an amount of about 46 to 47 atomic %.

11. The titanium aluminide alloy of claim 1, wherein the alloy has a lamellar microstructure substantially free of equiaxed structures at colony boundaries.

12. The titanium aluminide alloy of claim 1, wherein the alloy does not include Mo.

13. The titanium aluminide alloy of claim 1, wherein the Ti content is 57 to 60%, the Al content is 30 to 32%, the Nb content is 4 to 9%, the W content is 2 to 8% and the B content is 0.02 to 0.08%.

14. The titanium aluminide alloy of claim 1, including 45 to 55 at % Ti, 40 to 50 at % Al, 1 to 5 at % Nb, 0.3 to 1.5 at % W, and 0.1 to 0.3 at % B.

15. The titanium aluminide alloy of claim 1, comprising a sheet with a thickness of 8 to 30 mils.

16. The titanium aluminide alloy of claim 1, free of Cr, V, Co, Cu and Ni.

17. The titanium aluminide alloy of claim 1, comprising TiAl with 2 to 4 at % Nb, <= 1 at % Mo and 0.5 to 2 at % W, 0.1 to 0.3 at % B.

18. The titanium aluminide alloy of claim 1, including 1 to 4 at % Nb, <= 1 at % Mo and 0.25 to 2 at % W.

19. The titanium aluminide alloy of claim 1, wherein the alloy has been formed into an electrical resistance heating element capable of heating to 900 (degree) C. in less than 1 second when a voltage of up to 10 volts and up to 6 amps is passed through the heating element.

Two phase titanium aluminide alloy
WO9951787

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- **Fampat family**

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IN216237	B	2008-03-31	[IN-216237]
CA2319505	C	2009-10-06	[CA2319505]
JP4664500	B2	2011-04-06	[JP4664500]
NO333617	B1	2013-07-22	[NO-333617]

- **Abstract:**
  (EP1066415)
  A two phase titanium aluminide alloy having a lamellar microstructure with little intercolony structures. The alloy can include fine particles such as boride particles at colony boundaries and/or grain boundary equiaxed structures. The alloy can include alloying additions such as </= 10 at % W, Nb and/or Mo. The alloy can be free of Cr, V, Mn, Cu and/or Ni and can include, in atomic %, 45 to 55 % Ti, 40 to 50 % Al, 1 to 5 % Nb, 0.3 to 2 % W, up to 1 % Mo and 0.1 to 0.3 % B. In weight %, the alloy can include 57 to 60 % Ti, 30 to 32 % Al, 4 to 9 % Nb, up to 2 % Mo, 2 to 8 % W and 0.02 to 0.08 % B. (From WO9951787 A1)

Claims

(EP1066415)

1. A two-phase titanium aluminide alloy consisting of, in weight %, 50 to 65% Ti, 25 to 35% Al, 2 to 15 %Nb, less than 5%Mo, 1 to 10% W, and 0.01 to 0.2% B.
2. The titanium aluminide alloy of Claim 1, in an as-cast, hot extruded, cold worked, or heat treated condition.
3. The titanium aluminide alloy of Claim 1, wherein the alloy has a two-phase lamellar microstructure with fine particles are located at colony boundaries.
4. The titanium aluminide alloy of Claim 3, wherein fine boride particles are located at the colony boundaries.
5. The titanium aluminide alloy of Claim 3, wherein fine second-phase particles are located at the colony boundaries.
6. The titanium aluminide alloy of Claim 1, wherein the alloy has a two-phase microstructure including grain-boundary equiaxed structures.
7. The titanium aluminide alloy of Claim 1, wherein the Ti content is 57 to 60%, the Al content is 30 to 32%, the Nb content is 4 to 9%, the Mo content is at most 2%, the W content is 2 to 8% and the B content is 0.02 to 0.08%.
8. The titanium aluminide alloy of Claim 1, having a yield strength of more than 80 ksi (560 MPa), an ultimate tensile strength of more than 90 ksi (680 MPa) and/or tensile elongation of at least 1%.
9. The titanium aluminide alloy of Claim 1, wherein the alloy has a microstructure in which W is distributed non-uniformly.
10. The titanium aluminide alloy of Claim 1, wherein aluminum is present in an amount of about 46 to 47 atomic %.
11. The titanium aluminide alloy of Claim 1, wherein the alloy has a lamellar microstructure substantially free of equiaxed structures at colony boundaries.
12. The titanium aluminide alloy of Claim 1, wherein the alloy does not include Mo or Cr.
13. The titanium aluminide alloy of Claim 1, wherein the Ti content is 57 to 60%, the Al content is 30 to 32%, the Nb content is 4 to 9%, the W content is 2 to 8% and the B content is 0.02 to 0.08%.
14. The titanium aluminide alloy of Claim 1, including 45 to 55 at% Ti, 40 to 50 at% Al, 1 to 5 at% Nb, 0.3 to 1.5 at% W, and 0.1 to 0.3 at% B.
15. The titanium aluminide alloy of Claim 1, comprising a sheet with a thickness of 8 to 30 mils.
16. The titanium aluminide alloy of Claim 1, free of Cr, V, Mn, Co, Cu and Ni.
17. The titanium aluminide alloy of Claim 1, comprising TiAl with 2 to 4 at% Nb, <= 1 at% Mo and 0.5 to 2 at% W, 0.1 to 0.3 at% B.
18. The titanium aluminide alloy of Claim 1, including 1 to 4 at% Nb, <= 1 at% Mo and 0.25 to 2 at% W.
19. The titanium aluminide alloy of Claim 1, wherein the alloy has been formed into an electrical resistance heating element capable of heating to 900 DEG.C in less than 1 second when a voltage of up to 10 volts and up to 6 amps is passed through the heating element.

Creep resistant titanium aluminide alloys
WO200233138

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- **International Patent Classification**
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- **Fampat family**

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EP1322792	A1	2003-07-02	[EP1322792]
WO200233138	A9	2003-08-21	[WO200233138]
EP1322792	A4	2006-05-31	[EP1322792]

- **Abstract:**
  (WO200233138)
  A creep resistant titanium aluminide alloy having fine particles such as boride particles at colony boundaries and/or grain boundary equiaxed structures. The alloy can include alloying additions such as </= 10 at % W, Nb and/or Mo. The alloy can be free of Cr, V, Mn, Cu and/or Ni and can include, in atomic %, 45 to 55 % Ti, 40 to 50 % Al, 1 to 10 % Nb, 0.1 to 2 % W, up to 1 % Mo and 0.1 to 0.8 % B or the alloy can include, in weight %, 50 to 65 % Ti, 25 to 35 % Al, 2 to 20 % Nb, up to 5 % Mo, 0.5 to 10 % W and 0.01 to 0.5 % B. (From WO200233138 A9)

Claims

(WO200233138)

WHAT IS CLAIMED IS : 1. A titanium aluminide alloy consisting essentially of, in %, 50 to 65% Ti, 25 to 35% Al, 2 to 20 % Nb, 0.5 to 10% W and/or Ta, and 0.01 to 0.5% B.

2. The titanium aluminide alloy of Claim 1, in an as-cast, hot extruded, cold worked, or heat treated condition.

3. The titanium aluminide alloy of Claim 1, wherein the alloy has a two-phase nearly fully lamellar microstructure with fine particles are located at colony boundaries.

4. The titanium aluminide alloy of Claim 1, wherein fine boride particles are located at the colony boundaries.

5. The titanium aluminide alloy of Claim 4, wherein fine second-phase particles are located at the colony boundaries.

6. The titanium aluminide alloy of Claim 1, wherein the alloy has a two-phase microstructure including grain-boundary equiaxed structures.

7. The titanium aluminide alloy of Claim 1, wherein the Al content is 45 to 47 atomic %, the Nb content is 4 to 10 atomic %, the W content is 0.1 to 0.8 atomic % and the B content is 0.02 to 0.8 atomic %.

8. The titanium aluminide alloy of Claim 1, having a yield strength of more than 80 ksi (560 MPa), an ultimate tensile strength of more than 90 ksi (680
MPa) and/or tensile elongation of at least 1 %.

9. The titanium aluminide alloy of Claim 1, wherein the alloy has a microstructure in which W is distributed non-uniformly.

10. The titanium aluminide alloy of Claim 1, wherein aluminum is present in an amount of about 46 to 47 atomic %.

11. The titanium aluminide alloy of Claim 1, wherein the alloy has a lamellar microstructure substantially free of equiaxed structures at colony boundaries.

12. The titanium aluminide alloy of Claim 1, wherein the alloy does not include Mo or Cr.

13. The titanium aluminide alloy of Claim 1, wherein the Al content is 46 to 48 atomic %, the Nb content is 7 to 9 atomic %, the W content is 0.1 to 0.6 atomic % and the B content is 0.04 to 0.6 atomic%.

14. The titanium aluminide alloy of Claim 1, including 45 to 55 at% Ti, 40 to 50 at% Al, 1 to 10 at% Nb, 0.1 to 1.5 at% W, and 0.05 to 0.5 at% B.

15. The titanium aluminide alloy of Claim 1, comprising a sheet with a thickness of 8 to 30 mils.

16. The titanium aluminide alloy of Claim 1, free of Cr, V, Mn, Co,
Cu and Ni.

17. The titanium aluminide alloy of Claim 1, comprising TiAl with 6 to 10 at% Nb, 0.2 to 0.5 at% W, and 0.05 to 0.5 at% B.

18. The titanium aluminide alloy of Claim 1, including 1 to 9 at% Nb, s 1 at% Mo and 0.2 to 2 at% W.

19. The titanium aluminide alloy of Claim 1, wherein the alloy exhibits a creep rate of less than about 5x 10-'o under a stress of 100 MPa.

20. The titanium aluminide alloy of Claim 1, wherein the alloy exhibits a creep rate of less than about 10-9 under a stress of 150 MPa.

21. The titanium aluminide alloy of Claim 1, wherein the alloy exhibits a creep rate of less than about 10-8 under a stress of 200 MPa.

22. The titanium aluminide alloy of Claim 1, wherein the alloy exhibits a time to 0.5% creep strain of at least 1000 hours under a stress of 140 Mpa and temperature of 760 C.