Title (en)

Method for producing a component and component from a gamma-titanium-aluminium base alloy

Title (de)

Verfahren zur Herstellung eines Bauteiles und Bauteile aus einer Titan-Aluminium-Basislegierung

Title (fr)

Procédé de fabrication d'un composant et composants constitués d'un alliage à base d'aluminium-titane

Publication

EP 2386663 A1 20111116 (DE)

Application

EP 11450055 A 20110426

Priority

AT 8022010 A 20100512

Abstract (en)

Producing a component from titanium-aluminum-based alloy, comprises producing a melted- or powder metallurgically manufactured starting material with a composition comprising e.g. aluminum and isostatically pressing the starting material to a raw part, (b) subjecting the hot isostatic press-raw part to a hot forming step and transformation with subsequent cooling to form the component, (c) subjecting the component to a heat treatment to form a homogeneous, fine globular microstructure comprising an atomic structure exhibiting phase and optionally heat treating the component. Producing a component from titanium-aluminum-based alloy comprises: (a) producing a melted- or powder metallurgically manufactured starting material with a chemical composition comprising aluminum (41-48 atom%), niobium (4-9 atom%), molybdenum (0.1-3 atom%), manganese (up to 2.4 atom%), boron (up to 1 atom%), silicon (up to 1 atom%), carbon (up to 1 atom%), oxygen (up to 0.5 atom%), nitrogen (up to 0.5 atom %), titanium and residual impurities, and isostatically pressing the starting material to a raw part at a pressure increase of at least 150 MPa, at a temperature of at least 1000[deg] C after soaking for a period of at least 60 minutes; (b) subjecting the hot isostatic press-raw part to a hot forming step by fast-massive forming at a speed of greater than 0.4 mm/second, and a transformation by compressing measured as local elongation (A) of greater than 0.3, where A is ln(hf/ho) in which hf is height of the workpiece after compression and ho is height of the workpiece before compression, or other transformation process with same high minimum transformation, preferably by forging at 1000-1350[deg] C under the formation of the component with subsequent cooling, where the time period until reaching a temperature of 700[deg] C is more than 10 minutes, and a structure that is dynamically recovered or recrystallized in small portions and exhibits a deformation microstructure with high recrystallization energy potential, is formed; (c) subjecting the component for adjusting the desired material properties to a heat treatment, in which a homogeneous, fine globular microstructure, which comprises, at room temperature, an atomic structure exhibiting phase, is formed at an eutectoid temperature of the alloy, preferably at 1010-1180[deg] C with a period of 30-1000 minutes from the transformation structure, based on the stored transformation energy and driving force for structural transformation consisting of chemical phase imbalance after transforming and cooling, after cooling in an air, where the atomic structure exhibiting phase comprises: globular alpha 2 phase with a particle size of 1-50 mu m and with a volume fraction of 1-50% that contains isolated, coarse gamma - lamellae with thickness of greater than 100 nm; globular beta 0phase surrounding the alpha 2 phase, with a particle size of 1-25 mu m and with a volume fraction of 1-50%; and globular gamma phase surrounding the alpha 2 phase, with a particle size of 1-25 mu m and with a volume fraction of 1-50%; and (d) optionally performing at least a further heat treatment, preferably sequence annealing and/or stabilization annealing of the component. An independent claim is included for the component with: a near net shape dimension or with a microstructure of the material comprising the atomic structure exhibiting phase that comprises globular alpha 2 phase with a particle size of 1-50 mu m and with a volume fraction of 1-50% that contains isolated, coarse gamma - lamellae with thickness of greater than 100 nm, globular beta 0phase surrounding the alpha 2 phase, with a particle size of 1-25 mu m and with a volume fraction of 1-50%, and globular gamma phase surrounding the alpha 2 phase, with a particle size of 1-25 mu m and with a volume fraction of 1-50%, where the material has mechanical properties, preferably yield strength (R(p0.2)) of 650-910 Mpa at room temperature and 520-690 MPa at 700[deg] C, tensile strength (R m) of 680-1010 Mpa at room temperature and 620-690 MPa at 700[deg] C, and a total elongation (A t) of 0.5-3% at room temperature and 1-3.5% at 700[deg] C; or a near net shape dimension or with a microstructure of the material comprising supersaturated alpha 2 phase with a particle size of 5-80 mu m and with a volume fraction of 50-95% that optionally contains small fine gamma - lamellae, globular beta 0phase with a particle size of 1-20 mu m and with a volume fraction of 1-25%, and globular gamma phase with a particle size of 1-20 mu m and with a volume fraction of 1-28%, where the material has mechanical properties, preferably (R(p0.2)) of 650-940 Mpa at room temperature and 430-620 MPa at 700[deg] C, R mof 730-1050 Mpa at room temperature and 590-940 MPa at 700[deg] C, and A tof 0.2-2% at room temperature and 1-2.5% at 700[deg] C; or a near net shape dimension or with a microstructure of the material comprising alpha 2/gamma lamellar grain with a particle size of 5-100 mu m, a volume fraction of 25-98% and with a (alpha 2/gamma) lamellar fine structure, preferably with an average lamellar spacing of 10 nm-1 mu m, globular beta 0 with a particle size of 0.5-25 mu m and with a volume fraction of 1-25%, and globular gamma with a particle size of 0.5-25 mu m and with a volume fraction of 1-50%, where the material has mechanical properties, preferably (R(p0.2)) of 710-1020 Mpa at room temperature and 540-760 MPa at 700[deg] C, R mof 800-1250 Mpa at room temperature and 630-1140 MPa at 700[deg] C, and A tof 0.8-4% at room temperature and 1-4.5% at 700[deg] C, obtained by the above method.

Abstract (de)

Die Erfindung betrifft ein Verfahren zur Herstellung eines Bauteiles aus einer Ti-Al-Basislegierung sowie ein thermisch vergütetes Bauteil aus dieser. Um homogene, mechanische Eigenschaften, insbesondere hohe Duktilität und Kriechbeständigkeit bei hoher Festigkeit eines Werkstoffes insbesondere bei hohen Temperaturen zu erreichen, ist erfindungsgemäß vorgesehen, in einem ersten Schritt das Vormaterial einer HIP-Behandlung auszusetzen und in einem zweiten Schritt das Rohteil einer Schnell-Massivumformung zu unterwerfen, wonach in einem dritten Schritt durch Glühung im Bereich der eutektoiden Temperatur (T eu) der Legierung eine Feinkornausbildung mit den Phasen GAMMA, BETA 0 , ALPHA 2 erfolgt und das Bauteil mit endabmessungsnahen Dimensionen in einem nachfolgenden Schritt Folgeglühungen und/oder Stabilisierungsglühungen zur Einstellung des Gefüges und der mechanischen Werkstoffeigenschaften unterworfen wird.

IPC 8 full level

C22C 1/04 (2006.01); **C22C 14/00** (2006.01); **C22F 1/18** (2006.01)

CPC (source: EP US)

C22C 1/02 (2013.01 - EP US); **C22C 1/0458** (2013.01 - EP US); **C22C 14/00** (2013.01 - EP US); **C22F 1/183** (2013.01 - EP US); B22F 2998/10 (2013.01 - EP US)

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Designated contracting state (EPC)

AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

Designated extension state (EPC)

BA ME

DOCDB simple family (publication)

EP 2386663 A1 20111116; **EP 2386663 B1 20170802**; AT 509768 A1 20111115; AT 509768 B1 20120415; CA 2739964 A1 20111112; CA 2739964 C 20140218; ES 2644256 T3 20171128; IL 212821 A0 20110731; IL 212821 A 20141130; JP 2011236503 A 20111124; JP 2017122279 A 20170713; JP 6576379 B2 20190918; US 2011277891 A1 20111117; US 8864918 B2 20141021

DOCDB simple family (application)

EP 11450055 A 20110426; AT 8022010 A 20100512; CA 2739964 A 20110511; ES 11450055 T 20110426; IL 21282111 A 20110511; JP 2011119692 A 20110512; JP 2017035960 A 20170228; US 201113099970 A 20110503