

Title (en)  
MANUFACTURING OF HIGH STRENGTH AND HEAT RESISTANT ALUMINIUM ALLOYS STRENGTHENED BY DUAL PRECIPITATES

Title (de)  
HERSTELLUNG VON HOCHFESTEN UND WÄRMEBESTÄNDIGEN DURCH DUAL-PRÄZIPITATE VERSTÄRKTEN ALUMINIUMLEGIERUNGEN

Title (fr)  
FABRICATION D'ALLIAGES D'ALUMINIUM À HAUTE RÉSISTANCE MÉCANIQUE ET THERMIQUE RENFORCÉS PAR DES PRÉCIPITÉS DOUBLES

Publication  
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Application  
**EP 17468002 A 20171227**

Priority  
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Abstract (en)  
The present invention the Manufacturing of High Strength and Heat Resistant Aluminium Alloys Strengthened by Dual Precipitates relates to a high-strength and heat resistant aluminium alloy and a method for producing the same. The alloys possess 2.0-5.0 mass.% Mn; 0.001-2.0 mass.% Cr; 2.0-5.0 mass.% Cr + Mn; 0.001-0.5 mass.% V; 2.0-4.5 mass.% Cu; 0.001-0.9 mass.% Be; 0.05-0.5 mass.% Sc; and comprising of at least one element out of Zr, Y, Ti, Hf and Nb with a content of 0.001-0.4 mass.%; the balance being Al and inevitable impurities up to 0.5 mass.%. The alloys are cast with a cooling rate exceeding 100 K s<sup>-1</sup>. The alloys can be plastically deformed before aging. Afterwards, they are aged at a first ageing temperature for a first predetermined time. Then they are subjected to the second ageing treatment at a second temperature for a second predetermined time to obtain a combination of icosahedral and L 12 precipitates. The alloys can be aged at a third ageing temperature for a third predetermined ageing time after being quenched from the second ageing temperature.

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CPC (source: EP)  
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Citation (applicant)  

- WO 02063059 A1 20020815 - MCCOOK METALS L L C [US]
- WO 2008003503 A2 20080110 - ALERIS ALUMINUM KOBLENZ GMBH [DE], et al
- US 5759302 A 19980602 - NAKAI MANABU [JP], et al
- US 2017051383 A1 20170223 - KUMAR M SURENDRA [IN], et al
- US 5226983 A 19930713 - SKINNER DAVID J [US], et al
- WO 2011122958 A1 20111006 - NORSE HYDRO AS [NO], et al
- US 6074498 A 20000613 - WALDRON DOUGLAS J [US], et al
- US 6248453 B1 20010619 - WATSON THOMAS J [US]
- US 7909947 B2 20110322 - PANDEY AWADH B [US]
- US 8002912 B2 20110823 - PANDEY AWADH B [US]
- US 7871477 B2 20110118 - PANDEY AWADH B [US]
- US 5620652 A 19970415 - TACK WILLIAM T [US], et al
- US 2010143185 A1 20100610 - PANDEY AWADH B [US]
- US 5593515 A 19970114 - MASUMOTO TSUYOSHI [JP], et al
- US 5419789 A 19950530 - KITA KAZUHIKO [JP]
- US 5632826 A 19970527 - HULTIN-STIGENBERG ANNA [SE], et al
- EP 2598664 B1 20170118 - AIRBUS OPERATIONS GMBH [DE]
- N.A. BELOV; A.N. ALABIN; I.A. MATVEEVA: "Optimization of phase composition of Al-Cu-Mn-Zr-Sc alloys for rolled products without requirement for solution treatment and quenching", J. ALLOY. COMPD., vol. 583, 2014, pages 206 - 213
- F. SCHURACK; J. ECKERT; L. SCHULTZ: "Synthesis and mechanical properties of cast quasicrystal-reinforced Al-alloys", ACTA MATERIALIA, vol. 49, 2001, pages 1351 - 1361
- F. SCHURACK; J. ECKERT; L. SCHULTZ: "Synthesis and mechanical properties of quasicrystalline Al-based composites, Quasicrystals, Structure and Physical Properties", 2003, WILEY-VCH GMBH & CO. KGAA, pages: 551 - 569
- G.S. SONG; E. FLEURY; S.H. KIM; W.T. KIM; D.H. KIM: "Enhancement of the quasicrystal-forming ability in Al-based alloys by Be-addition", JOURNAL OF ALLOYS AND COMPOUNDS, vol. 342, 2002, pages 251 - 255, XP004373996, DOI: doi:10.1016/S0925-8388(02)00186-X
- N. ROZMAN; J. MEDVED; F. ZUPANIC: "Microstructural evolution in Al-Mn-Cu-(Be) alloys", PHILOS. MAG., vol. 91, 2011, pages 4230 - 4246
- D.H. KIM; K. CHATTOPADHYAY; B. CANTOR: "QUASI-CRYSTALLINE AND RELATED CRYSTALLINE PHASES IN A RAPIDLY SOLIDIFIED 2024-2LI ALUMINUM-ALLOY", ACTA METALLURGICA ET MATERIALIA, vol. 39, 1991, pages 859 - 875
- X.D. ZHANG; Y.J. BI; M.H. LORETTO: "STRUCTURE AND STABILITY OF THE PRECIPITATES IN MELT SPUN TERNARY AL-TRANSITION-METAL ALLOYS", ACTA METALLURGICA ET MATERIALIA, vol. 41, 1993, pages 849 - 853, XP024182858, DOI: doi:10.1016/0956-7151(93)90018-N
- X.D. ZHANG; M.H. LORETTO: "Stability and decomposition mechanisms of supersaturated solid solutions in rapidly solidified aluminium transition metal alloys", MATERIALS SCIENCE AND TECHNOLOGY, vol. 12, 1996, pages 19 - 24
- ZUPANIC, FRANC; WANG, DI; GSPAN, CRISTIAN; BONCLNA, TONICA: "Precipitates in a quasicrystal-strengthened Al-Mn-Be-Cu alloy", MATERIALS CHARACTERIZATION, vol. 106, August 2015 (2015-08-01), XP029254564, ISSN: 1044-5803, Retrieved from the Internet <URL:http://www.sciencedirect.com/science/article/pii/S1044580315001606> DOI: doi:10.1016/j.matchar.2015.05.013
- BONCLNA, TONICA; ZUPANIC, FRANC: "In situ TEM study of precipitation in a quasicrystal-strengthened Al-alloy", ARCHIVES OF METALLURGY AND MATERIALS, vol. 62, no. 1, 2017, ISSN: 1733-3490, Retrieved from the Internet <URL:http://www.imim.pl/files/archiwum/Vol1 2017/01.pdf, doi: 10.1515/amm-2017-0001>

Citation (search report)  

- [XA] RU 2287600 C1 20061120 - G OBRAZOVATEL NOE UCHREZHDENIE [RU]
- [A] US 5607523 A 19970304 - MASUMOTO TSUYOSHI [JP], et al
- [AD] US 5620652 A 19970415 - TACK WILLIAM T [US], et al
- [A] MOHAMED ET AL: "Improved LIBS limit of detection of Be, Mg, Si, Mn, Fe and Cu in aluminum alloy samples using a portable Echelle spectrometer with ICCD camera", OPTICS AND LASER TECHNOLOGY, ELSEVIER SCIENCE PUBLISHERS BV., AMSTERDAM, NL, vol. 40, no. 1, 15 September 2007 (2007-09-15), pages 30 - 38, XP022251770, ISSN: 0030-3992, DOI: 10.1016/J.OPTLASTEC.2007.04.004

- [A] BELOV N A ET AL: "Optimization of phase composition of Al-Cu-Mn-Zr-Sc alloys for rolled products without requirement for solution treatment", JOURNAL OF ALLOYS AND COMPOUNDS, vol. 583, 7 September 2013 (2013-09-07), pages 206 - 213, XP028747949, ISSN: 0925-8388, DOI: 10.1016/J.JALLCOM.2013.08.202
- [A] SONG G S ET AL: "Enhancement of the quasicrystal-forming ability in Al-based alloys by Be-addition", JOURNAL OF ALLOYS AND COMPOUNDS, ELSEVIER SEQUOIA, LAUSANNE, CH, vol. 342, no. 1-2, 14 August 2002 (2002-08-14), pages 251 - 255, XP004373996, ISSN: 0925-8388, DOI: 10.1016/S0925-8388(02)00186-X
- [A] ZUPANIC FRANC ET AL: "Precipitates in a quasicrystal-strengthened Al-Mn-Be", MATERIALS CHARACTERIZATION, vol. 106, 12 May 2015 (2015-05-12), pages 93 - 99, XP029254564, ISSN: 1044-5803, DOI: 10.1016/J.MATCHAR.2015.05.013
- [A] BOOTH-MORRISON C ET AL: "Role of silicon in accelerating the nucleation of Al(Sc,Zr) precipitates in dilute AlScZr alloys", ACTA MATERIALIA, ELSEVIER, OXFORD, GB, vol. 60, no. 12, 29 May 2012 (2012-05-29), pages 4740 - 4752, XP028425655, ISSN: 1359-6454, [retrieved on 20120601], DOI: 10.1016/J.ACTAMAT.2012.05.036

Cited by

CN112410624A; CN114107764A; RU2753537C1; CN113684393A; CN114737142A; CN111206194A; CN113789453A; CN117443982A; EP3720983A4; WO2019109135A1; US11746396B2; US11976343B2

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