

Article

Optimization of Flat-Rolling Parameters for Thermally Stable Alloy of Al-Cu-Mn System with Micro Additions of Si and Zr

Alexander Keshmin ^{1,2,*}, Stanislav Cherkasov ², Anastasiya Fortuna ³, Yury Gamin ² and Alexander Churyumov ⁴

¹ Scientific Activity Sector, Moscow Polytechnic University, Bolshaya Semenovskaya 38, 107023 Moscow, Russia
² Department of Metal Forming, National University of Science and Technology MISIS, Leninsky Prospekt 4, 119049 Moscow, Russia; y.gamin@misis.ru (Y.G.)
³ Department of Physical Materials Science, National University of Science and Technology MISIS, Leninsky Prospekt 4, 119049 Moscow, Russia
⁴ Department of Physical Metallurgy of Non-Ferrous Metals, National University of Science and Technology MISIS, Leninsky Prospekt 4, 119049 Moscow, Russia; churyumov@misis.ru

Abstract: The phase composition, microstructure, and mechanical properties of flat-rolled experimental Al-Cu-Mn system alloy with Si and Zr additions have been studied. The experimental results have been compared with data for the AA2219 commercial alloy pertaining to the same alloying system. Hot deformation of an experimental alloy causes the precipitation of ~100 nm sized dispersoids and refinement of the eutectic phase particles. The yield strength and relative elongation of the hot-deformed experimental alloy are 255 MPa and 8.6%, respectively. Subsequent cold deformation reduces the relative elongation by 3.5% and increases the yield strength by 50 MPa, while the ultimate tensile strength does not change. After long-term 200 °C exposure, the mechanical properties of the experimental alloy remain the same as those of the as-deformed one, whereas the yield strength of the 2219 alloy decreases by 2 times and the ultimate tensile strength by 1.4 times. Comparison of these experimental results with data for the 2219 alloy and other Al-Cu-Mn system alloys cited in this work and reported elsewhere suggests that a good thermal stability of Al-2Cu-2Mn-0.4Si-0.2Zr alloy rolled stock can be achieved through treatment using the regimes designed herein.



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1. Introduction

Aluminum and its alloys are widely used in a number of branches due to their unique combination of mechanical and physical properties, high processability, and, most importantly, low cost and abundance. Deformable 2xxx series aluminum alloys (Al-Cu and Al-Cu-Mn) have found broad application in the aircraft and spacecraft industries due to the possibility of their long-term operation over a wide temperature range without compromise in performance [1]. The 2219 (Al-6Cu-Mn) alloy of the abovementioned series is still commonly used as a construction material for operation at elevated (up to 315 °C) and cryogenic temperatures [2]. However, high performance of AA2219 alloy products can only be achieved after combined heat and deformation treatment including ingot homogenization, quenching, and aging of deformed semi-finished products [3]. This process route requires strict adherence to the processing parameters, which is difficult to realize in the conditions of large industrial enterprises and their narrow process windows, as it increases the overall time consumption and cost of production and dictates the necessity to use special process equipment. Furthermore, there are indications that the strength of this alloy decreases dramatically at elevated temperatures (above 200 °C) [4,5].

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Noel R. Rose

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The Immunoassay Handbook David Wild,2005-06-20 Containing updated and new information on advanced technology including micro and nanoscale immunoassays this text provides a mix of practical information coupled with a review of clinical applications and practical examples [Microparticle Reagent Optimization](#) Caryl Griffin,Jim Sutor,Bruce Shull,1994

[Micro/Nano Devices for Chemical Analysis](#) Manabu Tokeshi,Kiichi Sato,2018-07-03 This book is a printed edition of the Special Issue Micro Nano Devices for Chemical Analysis that was published in *Micromachines* [Journal of the Optical Society of America](#) ,2000 **Nanobiomaterials in Clinical Dentistry** Karthikeyan Subramani,Waqar Ahmed,2012-12-31

New nanomaterials are leading to a range of emerging dental treatments that utilize more biomimetic materials that more closely duplicate natural tooth structure or bone in the case of implants This book brings together an international team of experts from the fields of materials science nanotechnology and dentistry to explain these new materials and their applications for the restoration fixation replacement or regeneration of hard and soft tissues in and about the oral cavity and craniofacial region The main topics covered include applications in dental specialties Orthodontics Endodontics Pediatric dentistry Periodontics Prosthodontics and Implant dentistry salivary diagnostics using bioMEMS NEMS systems nanochips for oral cancer diagnosis biomimetic nanomaterials and nanotechnology for tooth repair and regeneration The editors previous book *Emerging Nanotechnologies in Dentistry* focused on the fabrication manufacturing processes of materials and dentistry applications This second book complements the first covers with coverage of the range of nanomaterials available today in clinical dentistry explaining the innovative techniques and applications in all of the main clinical dental specialties Nanobiomaterial engineers biomedical researchers biomedical engineers and dental oral pre clinical and clinical researchers will find the comprehensive coverage essential for working with nanotechnologies and materials in both clinical and research settings Book prepared by an interdisciplinary and international group of scientists and practitioners in the fields of nanomaterials dental implants medical devices and clinical practice Comprehensive professional reference for the subject covering materials fabrication and use of materials for all major diagnostic and therapeutic dental applications repair restoration regeneration implants and prevention Complements the editors previous book on nanotechnology applications for dentistry

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biomedia used in wastewater treatment plants and the effect on the surrounding environment of effluent wastewater pipes. These chapters also discuss the sampling methods, sample treatment and analysis techniques used so far for microplastics in wastewater. Additionally, the presence of microplastics in sewage sludge and in soils irrigated with wastewater or fertilized with sludge are discussed. The possible impact of plastics and their additives on plants, microalgae and humans are reviewed and presented in a critical way. Finally, a chapter summarizes all the relevant regulations and initiatives that point to the necessity of a global directive for the protection of the environment from plastic and microplastic pollution. The topic of microplastics in freshwater systems and in wastewater has scarcely been studied and requires more attention. *Microplastics in Water and Wastewater* aims to bring these initial findings to the attention of a broader audience and especially to operators and managers of freshwater and wastewater systems. It will also be helpful to people already aware of the marine debris problem to understand the sources of microplastics in the oceans from freshwater systems and wastewater treatment plants.

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technology syndrome of ectopic hormone produ ASM Handbook ASM International. Handbook Committee,1990 These volumes cover the properties processing and applications of metals and nonmetallic engineering materials They are designed to provide the authoritative information and data necessary for the appropriate selection of materials to meet critical design and performance criteria

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