Effect of microaddition of zirconium on the functional properties of copper magnesium alloy

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Abstract

Statement of the Problem:

The research was carried out with a view to minimise the share of alloying elements to obtain an alloy with high electrical conductivity intended for operation in high and variable mechanical, electrical load, and thermal stress. The research material were samples taken from ingots made of CuMg0,02 and CuMg0,02Zr0,012 alloys. Electrical conductivity tests were carried out using the eddy current method on the samples as cast. Then, the samples were cold rolled with a unit draft of 20% to the level of total deformation of 87%. The rolling speed was 0,5 m/s. The HV1 microhardness measurements were carried out on the samples after individual drafts, while the samples deformed with a total draft of 75% were subjected to a static tensile test. The samples after the rolling process with a total draft of 80%, were tested for electrical conductivity and recrystallisation annealing at a temperature of 100 - 580°C for 1 hour. Hardness changes were examined on the annealed samples using the Vickers method (HV10) and microstructure tests were carried out using light microscopy.

Conclusion & Significance: The addition of zirconium at the level of 0,012 wt.%. to the CuMg0,02 alloy after a total deformation of 75% increased from 397 MPa to 420 MPa (about 6%), while the microhardness for samples after a total deformation of 87% from 129 HV1 to 132 HV1 (about 2,5%). The addition of Zr caused a decrease in the electrical conductivity in the as cast state from the level of 58,28 MS/m for the CuMg0,02 alloy to the level of 55,16 MS/m (about 5%). After a total deformation of 80%, the alloy with the addition of Zr reached the electrical conductivity of 54,01 MS/m, and the base alloy 56,76 MS/m. After the one-hour annealing test, the recrystallization temperature for the base alloy was 350°C, while for the alloy with the micro-additive Zr 520°C (increase of the recrystallization temperature by about 49%).

Acknowledgments

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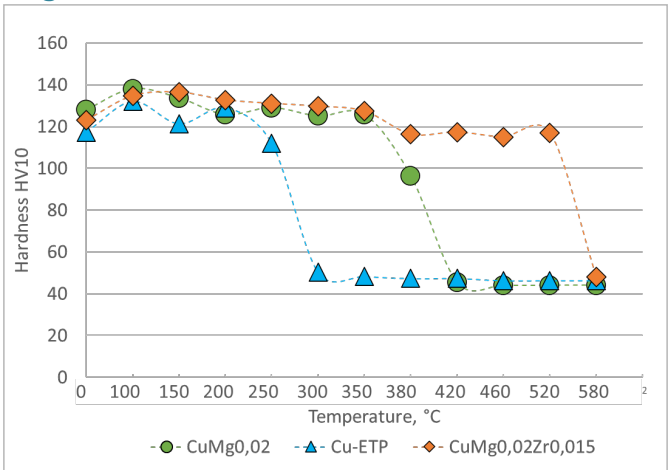
Image



The Influence of zirconium microaddition on the hardness of cold-rolled CuMg0,02 alloy after a 1-hour annealing process

Recent publications

1. Snopiński P, Matus K, Łagoda M, Appiah ANS, Hajnyš J (2024) Engineering an ultra-fine grained microstructure, twins and stacking faults in PBF-LB/M Al-Si alloy via KoBo extrusion method. Journal of Alloys and Compounds 970, 172576.
2. Bochniak W, Ostachowski P, Korbel A, Łagoda M (2023) Potential of the KOBO extrusion process for nonferrous metals in the form of solids and chips. The International Journal of Advanced Manufacturing Technology 127 (1), 733-750.
3. Korbel A, Błaż L, Bochniak W, Pawlyta M, Ostachowski P, Łagoda M (2023) Nano-Dimensional Elements in the Structure of Zinc Subjected to KOBO Extrusion. Metallography, Microstructure, and Analysis 12 (3), 427-432
4. Rdzawski Z, Kwaśniewski P, Głuchowski W, Łagoda M, Maleta M, Boczkal S, Franczak K (2023) Research on changes in microstructures and mechanical properties of welding caps as a result of their usage during resistance spot welding process. Archives of Metallurgy and Materials, 295-306.
5. Łagoda M, Głuchowski W, Maleta M, Domagała-Dubiel J, Sadzikowski M (2022) Characteristics of CuCrTiAl alloy after plastic deformation. Metalurgija 61 (3-4), 831-834

Photograph

Biography

Manager and contractor in 9 research and development projects, author or co-author of expert opinions from industry, 1 patents, 2 applications patent and 14 publications. The subject matter of the work included materials engineering and metal processing non-ferrous materials. In particular, technologies of large plastic deformations of plastically difficult materials.

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