The method of melting and casting of the CuTi4 alloy

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Abstract

Statement of the Problem: Among all copper alloys, copper-titanium alloys, both two-component and multi-component, cover a special place. The search for new, more favorable properties of these alloys does not stop and is constantly growing. These requirements are related not only to ensuring appropriate shapes and dimensions, but above all to achieving the appropriate microstructure of the alloy, guaranteeing compliance with these requirements for larger quantities of semi-finished products made of this alloy. An important role in this process is played by the optimal melting and casting of the material. The paper presents the technological assumptions for melting and casting a copper alloy with the addition of Ti 4% mass. The form and type of charge materials were characterized, as well as the method of their preparation and placing in the ceramic melting crucible. The charge was melted in an induction vacuum furnace and then casted into graphite crucibles using the original extender (funnel). Macro and microstructure analysis after casting was then performed using light and scanning microscopy. Then, hardness measurements were performed using the Vickers method and electrical conductivity was measured based on the complex impedance of the measurement probe. The aim of the research was to obtain castings with the desired macro and microstructure, as well as properties favorable for further plastic working.

Conclusion & Significance: Melting and casting the CuTi4 alloy using an induction vacuum furnace, high-purity input materials, and a specially constructed extension (funnel), allowed for obtaining high-quality ingots with the desired chemical composition. Analysis of the macro and microstructure of the cast material, performed using light and electron microscopy, showed a dendritic casting structure, that is typical for cylindrical copper alloy ingots

Acknowledgments

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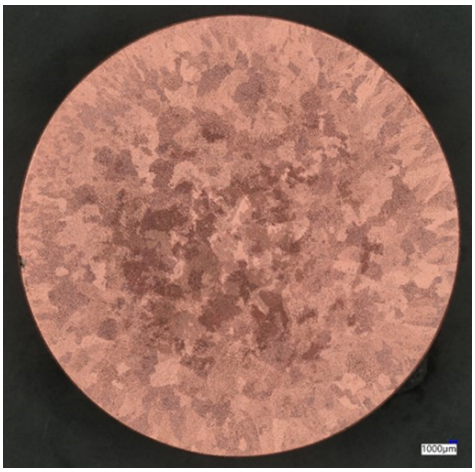

Figure 1. Macrostructure of CuTi4 ingot (diameter 60 mm). Light microscopy, etched specimen.

Recent Publications

1. Głuchowski W et al. (2023) Opracowanie założeń procesowych wytwarzania stopów miedzi z dodatkiem tytanu. Badania subwencyjne nr 0404135003, nr sprawozdania 8426/G/2023, Łukasiewicz-IMN (unpublished).
2. Wiśniewski K (2023), Zastosowanie materiałów na bazie miedzi i tytanu na przykładzie kompozytowego spoiwa lutowniczego Ti/CuNi50. Sympozjum Katedr i Zakładów Spawalnictwa.
3. Wiśniewski K, Rdzawski Z, Głuchowski W, Łagoda M, Musztyfaga-Staszuk M (2024) Optimization of the CuTi4 alloy melting and casting process. International Students Scientific Conference TalentDetector.
4. Wiśniewski K, Marszowski K, Kołacz D (2023) Opracowanie technologii wytwarzania kompozytu srebro/stal 316L. Badania subwencyjne nr 0414140003, nr sprawozdania 8420/G/2023, Łukasiewicz-IMN (unpublished).
5. Huang L, Cui Z, Meng X, Zhang X, Song X, Tang N, Xiao Z, Lei W, Li Z (2021) Effect of microelements on the microstructure evolution and properties of ultrahigh strength Cu-Ti alloys. Material Science and Engineering, Volume 823.

Photograph

Biography

A graduate of the Faculty of Mechanical Engineering at the Silesian University of Technology. After graduating, started working at the Institute of Non-Ferrous Metals. In his professional work, he participates in national and international projects, mostly in the field of 3D printing and broadly understood copper processing. He deals primarily with structural research and their impact on physico-mechanical properties. In 2023, started a doctoral thesis in the field of copper-titanium alloys.

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