

Enhancing the Rollability of Cu-Ge-Ni Alloy through Heat Treatment Methods

Authors : Morteza Hadi

Abstract : This research investigates the potential enhancement of the rollability of Cu-Ge-Ni alloy through the mitigation of microstructural and compositional inhomogeneities via two distinct heat treatment methods: homogenization and solution treatment. To achieve this objective, the alloy with the desired composition was fabricated using a vacuum arc remelting furnace (VAR), followed by sample preparation for microstructural, compositional, and heat treatment analyses at varying temperatures and durations. Characterization was conducted employing optical and scanning electron microscopy (SEM), X-ray diffraction (XRD), and Vickers hardness testing. The results obtained indicate that a minimum duration of 10 hours is necessary for adequate homogenization of the alloy at 750°C. This heat treatment effectively removes coarse dendrites from the casting microstructure and significantly reduces elemental separations. However, despite these improvements, the presence of a second phase with markedly different hardness from the matrix results in poor rolling ability for the alloy. The optimal time for solution treatment at various temperatures was determined, with the most effective cycle identified as 750°C for 2 hours, followed by rapid quenching in water. This process induces the formation of a single-phase microstructure and complete elimination of the second phase, as confirmed by X-ray diffraction analysis. Results demonstrate a reduction in hardness by 30 Vickers, and the elimination of microstructural unevenness enables successful thickness reduction by up to 50% through rolling without encountering cracking.

Keywords : Cu-Ge-Ni alloy, homogenization, solution treatment, rollability

Conference Title : ICMME 2024 : International Conference on Metallurgical and Materials Engineering

Conference Location : Batumi, Georgia

Conference Dates : May 20-21, 2024