MICROSTRUCTURAL ANALYSIS AND 3D MODELING OF POROUS COPPER FOR HIGH-CURRENT CONTACTS

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This research focuses on developing and characterizing a porous copper matrix designed for high-performance electrical contact applications. Samples were fabricated with the addition of a pore-forming agent in the range of 10–35 wt.%, followed by sintering to remove the agent. The methodology included density measurement, Vickers microhardness testing, and porosity evaluation using X-ray computed tomography and optical microscopy [1].

It was found that pressing pressure in the range of 3–5 t/cm² provides the most stable density values before and after sintering, indicating effective compaction and a predictable porous structure. Vickers microhardness values reached 160–170 HV at a pre-sintering density of 4.5–5.0 g/cm³. The decrease in density after sintering confirms the formation of pores, with hardness values correlating with pore volume.

X-ray tomography enabled three-dimensional analysis of pore distribution, size, and shape. The average pore volume was 0.00328 mm³, with mostly irregular shapes (average sphericity = 0.528). Statistical correlations were established between pore geometry (diameter, surface area, volume) and shape descriptors (sphericity, compactness) [2].

The results confirm the suitability of the developed material as a porous matrix for infiltration with low-melting alloys. Such materials have high potential for use in high-current arc-free switching devices, where thermal conductivity, structural stability, and low contact resistance are essential.

Literature:

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