The role of the activator rich-W interboundary layer on liquid phase sintering of W-pre-alloy bronze compositesof Fe and Co additions

Abstract

In this study, the effects of 1-3 wt.% Fe and Co additions on the sintering of W 40-80wt.%-pre-alloy bronze Sn 10 wt.%-Cu compacts were examined. The isothermal part of the sintering process was conducted at temperatures ranging from 920 °C to 1300 °C for 3 h. Relative sintered densities in the range of 70-90% were achieved. The gain in the sintered densities due to activator addition was 5-15%. The sintering activation effects started at temperatures as low as 600 °C below the bulk eutectic temperature. SEM, XRD and EDX tests proved that Fe and Co-rich crystalline interboundary layers completely wet the tungsten grain boundaries in the solid state and act as a short-circuit diffusion path for mass transportation. These outcomes seem to follow the classical activated sintering model and contrast with some other recently proposed models, whereby a detected nanometer-thick, activator-enriched disordered film at W grain boundary is considered fully responsible for the solid-state activated sintering.