

## **Sintering Behavior and Microstructure Evolution of Mechanically Alloyed W–Bronze Composite Powders by Two-step Ball Milling Process**

### Abstract

The miscibility of W in Sn and Cu is extremely poor. Sintering of W–bronze composites to their full density is proved to be difficult. To tackle this problem, the ball milling process of the W–bronze powder mixture proposed in this study was split into two steps. In the first step, the softness of Sn powder was exploited to modify the surface morphology of W particles. In the second step, Cu was added to the ball milled mixture. To achieve this goal, four 50 wt% W–bronze compact sets of different powder precursors and activator additions were produced. The sintering process was performed at 1150 °C. The two-step ball milled powder yielded sintered compacts of homogeneous microstructure of fine polygonal W grains dispersed in bronze matrix. They showed the highest hardness and densification levels. The sintered density, microstructure, hardness and densification mechanisms of the sintered compacts were investigated, examined and evaluated using different metallographic, microscopic and measurement facilities.

**Keywords:** Metal matrix composites, Mechanical alloying, Sintering, Microstructure, Scanning electron microscopy