

Powder Hot Isostatic Pressing of Ti-based Metal Matrix Composites

Malallah Al-lawati^{1, 2}, Raja H.U. Khan³, Moataz M. Attallah¹

1. University of Birmingham, School of Metallurgy and Material, Edgbaston, B15 2TT, UK.

2. National Structural Integrity Research Centre (NSIRC), Cambridge, CB21 6AL, UK

3. TWI Ltd, Granta Park, Great Abington, CB21 6AL, Cambridge, UK.

Ti-alloys offer a high specific strength, but with lower hardness, wear and heat resistance properties. The development of Ti-based metal matrix composites (TMMCs) using powder metallurgy hot isostatic pressing (PM HIP) can help produce alloys with significant improved hardness and wear resistant characteristics. In this work, Ti6Al4V (Ti-64) powders (acting as the matrix) were blended with ceramic powders of different types i.e., silicon carbide (SiC) and titanium diboride (TiB₂), with varying volume fractions and particle sizes. The blended powders were filled into canisters and HIPped using different processing conditions (i.e., temperature, pressure, dwell time) in order to assess their suitability and impact on the consolidation and the resulted mechanical & tribological properties. Although Ti-64 reinforced with 10v.% TiB₂ has almost double the hardness compared to monolithic Ti-64, which is quite promising for various wear-resistance applications. However, both Charpy impact toughness and ductility have significantly reduced. The HIPped TMMCs microstructures, in regards to the formation of different phases, were analysed by X-ray diffraction (XRD) and scanning electron microscope (SEM) techniques.