J Material Sci Eng 2018, Volume 7
DOI: 10.4172/2169-0022-C8-114

Microstructure and electrochemical behaviour of ceramic reinforced titanium matrix composites fabricated by spark plasma sintering

Sifiso Maseko
Tshwane University of Technology, South Africa

The human physiological fluids are composed of aggressive anions such as chlorides, sulphides, fluorides and phosphides, which cause dissolution of the Ti oxide layer. Corrosion attack of titanium-based implants has adverse effects on titanium's biocompatibility (Toptan et al. 2016:152). Spark plasma sintering (SPS) technique is a highly advantageous powder consolidation technique, that is pronounced to fabricate specimen that perform significantly better than products produced by traditional sintering and casting methods. This technique provides high grain-growth retention and significantly less energy intensive than other methods. The purpose of this study is to synthesize titanium matrix composites with improved anti-corrosion properties through the incorporation of TiB2 ceramics particulates. The composites will be fabricated with a state-of-the-art sintering technology. Ti and TiB2 powders were used as the feedstock materials. The powders were blended and mixed for 8 h to fabricate sets of binary composites; Three composites of Ti-TiB2 binary system were prepared. The ad-mixed powders were then densified at 1350 °C, at a holding time of 5 min, with a heating rate and applied pressure of 100 °C/min and 50 MPa respectively. The microstructure and phase evolution of sintered products were then characterized using the optical microscope (OM), scanning electron microscope equipped with an energy-dispersive X-ray spectroscopy (SEM/EDS), and X-ray diffractometer (XRD). The corrosion properties were analyzed using potentiostat using linear polarization and impedance spectroscopy methods. The OM micrographs showed that at high TiB2 compositions the microstructure was more refined with definite presence of needle-like whiskers uniformly dispersed throughout the matrix material. The XRD results also depicted significant formation of the TiB; this is an indication that the SPS conditions favoured the evolution of TiB2 to TiB and no other boron-based species were formed during processing at high temperatures. The high reinforcement composition depicted enhanced anti-corrosion performance.

maseko.sfiso@yahoo.com