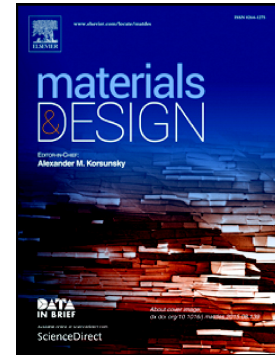


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Spark plasma sintering of graphitized multi-walled carbon nanotube reinforced Ti6Al4V

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Abstract

Graphitized multi-walled carbon nanotubes (MWCNT_{Gr}) reinforced Ti6Al4V (Ti64) matrix composites prepared via the powder metallurgy route were synthesized by spark plasma sintering (SPS) technique. 1, 2 and 3 wt % MWCNT_{Gr} were dispersed in the Ti64 matrices by adapted high energy ball milling (HEBM_A). Composite powder mixtures were sintered in vacuum at constant applied pressure, heating rate and isothermal holding time of 50 MPa, 100 °C/min and 5 min respectively. The sintering temperature was varied between 850 and 1000 °C. Scanning electron microscopy (SEM), transmission electron microscopy (TEM) and X-ray diffraction (XRD) were used to characterize the as-received MWCNTs, MWCNT_{Gr}, admixed composite powders and the bulk sintered composites. MWCNT_{Gr} evolution during graphitization treatment, dispersion in Ti64 matrix and in the sintered composites was analyzed using the characteristic Raman peak intensity ratio (I_D/I_G). The relative density of the sintered MWCNT_{Gr}/Ti64 composites was enhanced with increased sintering temperature, but deteriorated with increased wt % MWCNT_{Gr} in the metal matrix. Vickers microhardness of the consolidated composites improved with increasing sintering temperature and weight fractions of MWCNT_{Gr} over that of the unreinforced matrix alloy. The formation of crystalline TiC interfacial product during composite powder processing and consolidation is also discussed.

Keywords: Metal matrix composites; Reinforcement; MWCNT dispersion; Interfacial reaction; Graphitization

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