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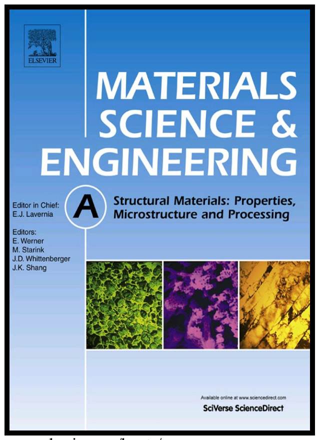

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Processing and characterization of spark plasma sintered copper/carbon nanotube composites

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Abstract

A Copper (Cu) matrix composites reinforced with 0.2, 5 and 10 vol% single walled carbon nanotubes (SWCNT) and 5 and 10 vol% multi-wall carbon nanotubes (MWCNT) was processed by high energy attritor milling of pure copper powder with carbon nanotubes (CNT) and subsequently consolidated by spark plasma sintering (SPS). Microstructural characterization shows a network of CNT along the grain boundaries and the presence of porosities at grain boundaries as well as triple junctions. By covering the particle boundaries, the higher volume fraction of CNT makes the sintering difficult as compared to single phase copper or low volume fraction CNT composites. Raman spectroscopy indicates that there is an increase in number of defects in the nanotube after milling and sintering of the composite. Mechanical properties evaluation shows that SWCNT composites results in higher strength and deformability compared to MWCNT. The failure strain decreases with increase in volume percent of CNT due to clustering of CNTs.

keywords: multiwall carbon nanotube, single wall carbon nanotube, spark plasma sintering, copper, hardness, composites.