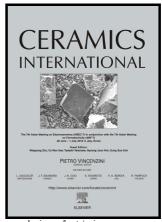
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Carbon Nanotube/Titanium Carbide Sol-gel Coated Zirconium Diboride Composites

Prepared by Spark Plasma Sintering

Yang Miao^{a*}, Xiaojing Wang^b, Yi-Bing Cheng^{b, c*}

^a College of Materials Science and Engineering, Taiyuan University of Technology, Taiyuan, 030024, China

^b Department of Materials Science and Engineering, Monash University, Melbourne, 3800, Australia

^c Department of Materials Science and Engineering, Wuhan University of Technology, Wuhan, 430070, China

Abstract

With combination of a powder processing technique and a sol-gel process, carbon

nanotube/titanium carbide coated zirconium diboride matrix composite was fabricated.

Zirconium diboride (ZrB₂) powders were coated with a functionalized carbon nanotubes (CNTs)

mixed titanium carbide (TiC) sol-gel precursor. As the results suggests, the carbothermal

reduction produced nanosized TiC grains at the surface of the ZrB₂ particles with a homogenous

distribution of CNTs. The densification of the CNT/TiC coated ZrB2 matrix composite was

achieved via 1900 °C spark plasma sintering(SPS). The TiC grains and the CNTs were primarily

concentrated in the grain boundaries of the ZrB₂ and showed the pinning effects that restrained

the growth of ZrB2 grain. The TiC grain diffusion in the sintering coarsened the grains from

nanosizes to 1-2 µm, which improved the densification of the ZrB₂. Due to the difference in

coefficient of thermal expansion, CNTs bridged the gaps between the TiC and the ZrB2 matrix,

which formed a weak-bonding interface. The major toughening mechanism found was crack

deflection via the TiC grains on the ZrB₂ matrix.

Keywords: Carbon nanotube, Sol-gel, SPS, Titanium carbide, ZrB₂

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