Carbosilisiothermic reduction of rutile to produce nano-sized particles of TiC and its composite with SiO2

ABSTRACT

Ceramic nanoparticles of TiC were successfully synthesized in a matrix of SiO2 by high-energy ball milling with subsequent heat treatment. The milling procedure includes milling of a mixture of TiO2, Si, and graphite powders at ambient temperature in an inert gas (Ar) atmosphere. The structural evaluation of powder particles has been accomplished by XRD, TEM, SEM, EDX, and DSC. XRD results suggest that the TiC-SiO2 nanocomposite was produced after 10 hours of mechanical activation with subsequent heat treatment at 1473 K (1200 °C) for 7 minutes. TEM images reveal that the TiC and SiO2 crystallites are <14 and 12 nm in size, respectively. The fracture toughness, and Vickers hardness values of the TiC-SiO2 nanocomposite are measured to be 3.82 MPa m1/2 and 19.9 GPa, respectively. Dimethylsulfoxide is used to eliminate SiO2 from the final products.

Keyword: TiC ceramic nanoparticles; TiC-SiO2 composite powder; Ball milling; Fabrication