

## Carbosisiothermic reduction of rutile to produce nano-sized particles of TiC and its composite with SiO<sub>2</sub>

### ABSTRACT

Ceramic nanoparticles of TiC were successfully synthesized in a matrix of SiO<sub>2</sub> by high-energy ball milling with subsequent heat treatment. The milling procedure includes milling of a mixture of TiO<sub>2</sub>, 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-SiO<sub>2</sub> 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 SiO<sub>2</sub> crystallites are <14 and 12 nm in size, respectively. The fracture toughness, and Vickers hardness values of the TiC-SiO<sub>2</sub> nanocomposite are measured to be 3.82 MPa m<sup>1/2</sup> and 19.9 GPa, respectively. Dimethylsulfoxide is used to eliminate SiO<sub>2</sub> from the final products.

**Keyword:** TiC ceramic nanoparticles; TiC-SiO<sub>2</sub> composite powder; Ball milling; Fabrication