**Highly oxidation resistant ZrB2-20SiC-2.5Si3N4 composites**

**processed via multi-stage spark plasma sintering**

**Sravan Kumar Thimmappa**

Metallurgical and Materials Engineering Department, National Institute of Technology, Warangal, 506 004, India

*sra1tkumar@gmail.com*

**Brahma Raju Golla**

Metallurgical and Materials Engineering Department, National Institute of Technology, Warangal, 506 004, India

**ABSTRACT**

Single-stage (SS) and multi-stage (MS) spark plasma sintering (SPS) processes were employed to densify ZrB2-20vol.%SiC-2.5vol.%Si3N4. Within the used experimental conditions, the single-stage SPSed ZrB2 composites measured with low density and poor properties. The multi-stage SPSed ZrB2-20vol.%SiC-2.5vol.%Si3N4 exhibited almost full density (~ 99%), very high hardness (27.3 GPa) and good oxidation resistance up to 1600 °C for 10 h. The microstructure of oxidized sample composed of thick ZrO2-SiO2 layer with unreacted bulk and no sign of SiC depleted layer.

*Keywords: Ceramics; Oxidation; Spark plasma sintering; ZrB2 Ultra High Temperature Ceramics; Microstructure; Hardness*