Fabrication of TaSi2-SiC Composite by High Frequency Induction Heated Combustion Synthesis and its Mechanical Properties

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Abstract

TaSi2 has excellent corrosion resistance in most mineral acids and has found applications as a material of construction in the chemical-processing industry for heaters, heat exchangers, reaction vessels and impellers for pumps and as a electrode in the glass industry. This study is about the fabrication of nano-structured TaSi2-SiC composite by high-frequency induction heated combustion synthesis and its mechanical properties.

Powders of tantalum carbide (>325mesh, 99.5% purity) and silicon (>325mesh, 99.5% purity) were used in this study. First TaC and 3Si powder mixtures were milled in a high-energy ball mill, Pulverisette-5 planatary mill, with 250rpm and 10hr. The significant reduction of particle size was obtained after the milling.

Using the HFIHCS method, the simultaneous synthesis and densification of TaSi2-SiC composite can be achieved in one step within 75sec. The relative density of the composite was 97% for the applied pressure of 60MPa. The average hardness and fracture toughness values obtained were 1370kg/mm2 and 8.6MPa·m1/2, respectively. The average grain sizes of TaSi2 and SiC fabricated by HFIFCS method were determined to be about 250nm and 130nm, respectively..