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## Microstructure and mechanical properties of SiC joint with an in-situ formed SiC-TiB<sub>2</sub> composite interlayer

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### Abstract

Diffusion bonding of SiC ceramic with in-situ formed SiC-TiB<sub>2</sub> composite interlayer by reactive spark plasma sintering with B<sub>4</sub>C-Ti<sub>3</sub>SiC<sub>2</sub>-Si powder mixture was investigated. It was found that a dense composite interlayer between the SiC ceramic substrate could be obtained at 1600 °C for 10 min. Granular-shaped SiC with submicron-size and elongated TiB<sub>2</sub> with micro-size were uniformly distributed in the bonding layer. The joint strength and hardness of the composite interlayer increased as the joining temperature increased up to 1600 °C due to the improved relative density and the higher fraction of elongated TiB<sub>2</sub> phase. The grain growth and formation of micro-cracks deteriorated the mechanical strength of the 1700 °C joint. The maximum shear strength of 128.0 ± 7.3 MPa was achieved for the joint bonded at 1600 °C. The toughening mechanisms of crack deflection, crack bridging and crack branching, and hardening mechanism of dual phase strengthening were observed in the morphology of indentation cracks.

**Keywords:** Ceramic composite; Silicon carbide; Joining; Microstructure; Spark plasma sintering

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