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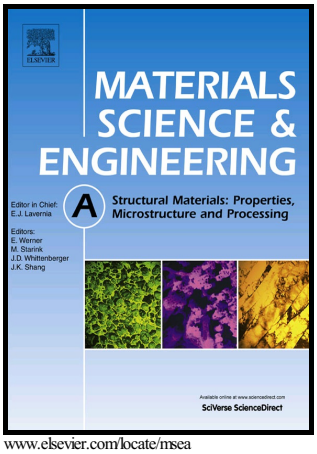

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Microstructure and mechanical properties of SiC joint with an in-situ formed SiC-TiB_2 composite interlayer

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Abstract

Diffusion bonding of SiC ceramic with in-situ formed SiC-TiB_2 composite interlayer by reactive spark plasma sintering with B_4C-Ti_3SiC_2-Si powder mixture was investigated. It was found that a dense composite interlayer between the SiC ceramic substrate could be obtained at 1600 ^oC for 10 min. Granular-shaped SiC with submicron-size and elongated TiB_2 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 ^oC due to the improved relative density and the higher fraction of elongated TiB_2 phase. The grain growth and formation of micro-cracks deteriorated the mechanical strength of the 1700 ^oC joint. The maximum shear strength of 128.0 ± 7.3 MPa was achieved for the joint bonded at 1600 ^oC. 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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