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Processing-temperature dependent micro- and macro- mechanical properties of SiC fiber reinforced SiC matrix composites

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Abstract: The processing temperature dependent microstructure, micro- and macro-mechanical properties of a SiC fiber reinforced SiC matrix composite system that was fabricated by polymer impregnation and pyrolysis were studied by novel characterization methods like transmission electron microscopy, nanoindentation, fiber push-in, micropillar splitting, etc. In the processing temperature range of 800~1000 °C, the SiC matrix was more crystallized as the processing temperature increased, leading to enhanced Young's modulus, hardness, but reduced fracture toughness at higher temperatures. In comparison, the SiC fiber remained stable in both the microstructure and the mechanical properties. The fiber/matrix interface was chemically bonded by a thin SiO₂ interphase, resulting in a high interfacial shear strength that was also insensitive to the processing temperature. Introduction of the BN interphases could significantly reduce the interfacial strength by impeding the interfacial reactions between the SiC fiber and the SiC matrix. Finally, the macro fracture strength of the

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