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TAILORED INTERFACE FOR HIGH PERFORMANCE OXIDE FIBER REINFORCED CERAMIC MATRIX COMPOSITES

Abstract

Continuous fiber reinforced ceramic matrix composites (CMCs) are under active consideration for multi-functional, large, complex high temperature structural components in aerospace and automotive applications. To take advantage of the full potential of the composite constituents, an adequate interface design on the micro/nano-scale is critical in the processing of CMCs as the toughness and the reliability depends on the optimization of the fiber-matrix bond. Additional tailored interface via coating of the fiber surface designed can meet three different demands: (1) to improve the interactions of fiber and matrix; (2) to provide an adequate fiber-matrix adhesion; (3) to act as a diffusion barrier and thus to maintain the original fiber strength. In the present work, tailored interfaces of oxide fiber (including mullite/alumina fiber and quartz fiber) reinforced ceramic matrix composites are designed. Precursor infiltration pyrolysis (PIP), electrophoretic deposition (EPD), hydrothermal methods are introduced to prepared different interlayers, such as BN, ZnO, silica and mullite et al. Typically, definite BN texturing interface are prepared by PIP processing. The relation of microstructure and thickness to mechanical properties of coating fiber are investigated, which lead to the remarkable improvement of mechanical properties for the CMCs (such as the tensile strength increase more than 200% compared to the CMCs without any interface). Other kinds of interfaces induced by different methods also have been investigated and related properties are performed. These studies promoted the construction of high performance multi-functional CMCs which could integrate mechanical, wave-transparent, high temperature tolerance properties together.