FORMATION OF CARBON INTERPHASE ON POLYCRYSTALLINE AND AMORPHOUS SIC FIBERS IN SIC/SIC COMPOSITES BY ELECTROPHORETIC DEPOSITION

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Continuous silicon carbide fiber-reinforced silicon carbide matrix (SiC/SiC) composites have been recognized as key materials for aerospace industries, high-temperature gas turbines and future nuclear and fusion applications because they show a pseudo-ductile fracture behavior and excellent fracture tolerance. Fiber/matrix interfaces act as an important role for toughening and strengthening SiC/SiC composites. Currently, carbon or hexagonal-boron nitride has been formed on SiC fibers as the interphases, and these interphases have been generally formed by chemical vapor infiltration (CVI), chemical vapor deposition (CVD) or solution-coating/pyrolysis process. However, these processes generally require long manufactuiring time and complicated apparatuses, and they use toxic, flammable or combustible reactant gases, resulting in much higher production cost and an increase in environmental load. Present authors paid attention to EPD process to form interphases on SiC fibers in SiC/SiC composites and demonstrated that EPD process was effective to form homogeneous C-interphase on SiC fibers [1-5]. In this study, EPD was applied for carbon interphase formation on polycrystalline (electric conductive) and amorphous (low electric conductive) SiC fibers in SiC/SiC composites, and microstructure and mechanical properties of the SiC/SiC composites were evaluated. From TEM micrograph of carbon interphase on the polycrystalline SiC fiber in the SiC/SiC composite formed by EPD, it was observed that flaky carbon particles were deposited parallel to the SiC fiber. Carbon has a layered structure and the layers bonded by weak van der Waals forces enable a low friction coefficient. As a result, the SiC/SiC composites with carbon interphases showed excellent mechanical properties with a pseudo-ductile fracture behavior. For amorphous SiC fibers, thin electric conductive polymer was coated on the amorphous SiC fibers, and carbon interphase formation was successfully achieved by EPD. The SiC/SiC composites reinforced with the carbon-coated amorphous SiC fibers also showed pseudo-ductile fracture behavior.

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