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Effects of sintering additives on the microstructural and mechanical properties of the ion-irradiated SiC_f/SiC

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Abstract

SiC_f/SiC composites containing three different types of sintering additives *viz.* Sc-nitrate, Al_2O_3-Sc_2O_3, and Al_2O_3-Y_2O_3, were subjected to ion irradiation using 0.2 MeV H^+ ions with a fluence of 3×10^{20} ions/m^2 at room temperature. Although all composites showed volumetric swelling upon ion irradiation, SiC_f/SiC with Sc-nitrate showed the smallest change followed by those with the Al_2O_3-Sc_2O_3 and Al_2O_3-Y_2O_3 additives. In particular, SiC_f/SiC containing the conventional Al_2O_3-Y_2O_3 additive revealed significant microstructural changes, such as surface roughening and the formation of cracks and voids, resulting in reduced fiber pullout upon irradiation. On the other hand, the SiC_f/SiC with Sc-nitrate showed the highest resistance against ion irradiation without showing any macroscopic changes in surface morphology and mechanical strength, indicating the importance of the sintering additive in NITE-based SiC_f/SiC for nuclear structural applications.

Keywords: SiC_f/SiC; EPD; Irradiation; Flexural strength; Volumetric swelling

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