Radiation Tolerance in Amorphous SiOC and Amorphous SiOC/Crystalline Fe Nanocomposite

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ABSTRACT The operation of existing fission reactors provides more than 10% electricity worldwide, nearly 20% in the US. The advance to Generation IV nuclear reactor brings more challenges in structural materials. To revolutionarily develop new materials that maintain their desired properties while being driven very far from equilibrium, we examined the radiation stability of amorphous silicon oxycarbide (SiOC) and amorphous SiOC/crystalline Fe nanocomposites. The highlight of our previous work shows that amorphous SiOC alloys are extremely thermal and irradiation stable over a wide range of composition, irradiation dose and irradiation temperature. By contrast with other solids, where implanted helium (He) becomes immobilized in nanometer-scale precipitates, He in SiOC remains in solution and outgasses from the material *via* atomic-scale diffusion without damaging its free surfaces. Nanocomposites of these materials with crystalline Fe also exhibited good irradiation stability at both room temperature and elevated temperatures. All the findings suggest SiOC/Fe as a promising candidate of structural materials for advanced nuclear reactors.