

Radiation-induced Cr cluster formation in W-Cr-Y alloy

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Irradiation of the promising alloys W-10wt%Cr-0.5wt%Y suggested as the first wall (FW) protection material in the case of the next demonstrative thermonuclear reactor, DEMO, has been performed with 5.6 MeV Fe and 5.9 MeV Co ions at 300 and 500C to the dose peak of 12 dpa. Atom probe tomography (APT) and transmission electron microscopy (TEM) methods have been used for study the chemical compositions at the atomic scale in the W-10wt%Cr-0.5wt%Y alloy before and after irradiation. The formation of nanoscale clusters enriched with Cr of the mean size of (2 ± 0.4) and (1.8 ± 0.4) nm irradiated at 300 and 500 C, respectively, in the damage region was observed. The concentration of Cr in Cr clusters increases from 48at.% to 78at.% with increasing the temperature from 300 C to 500 C but the mean size decreases. This indicates that the Cr clusters became to be more compact. The same density of $(3-6.3) \times 10^{24} \text{m}^{-3}$ of Cr clusters was found at both irradiation temperatures of 300 and 500C. Beyond the damage region, Cr clusters were not observed.

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