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Deuterium and helium retention in W-Cr-Y alloys

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The retention of deuterium in tungsten-chromium-yttrium alloys, W-11.4Cr-0.6Y and W-10Cr-0.5Y, was investigated by means of in-situ thermal desorption spectroscopy (TDS). The first alloy was manufactured by field-assisted sintering technology (FAST) while W-10Cr-0.5Y alloy was produced by hot isostatic pressing followed by heat treatment (HIP+HT). Both alloys were irradiated with D3+ ions (670eV/D) and a fluence of 1021 D/m2 at temperatures of 300, 600, 900 K. In the case of W-11.4Cr-0.6Y alloy, deuterium retention was investigated during sequential irradiation with helium (3 keV) and deuterium (670eV/D) ions at room temperature with fluences of 1019–7×1022 He/m2 and 1021 D/m2, respectively. An increased D retention in W-Cr-Y alloys compared to pure W is shown. The D retention was higher for W-11.4Cr-0.6Y alloy manufactured by FAST compared to W-10Cr-0.5Y alloy obtained by HIP+HT technologies. The main reason is the smaller grain size of 0.1 □m for W-11.4Cr-0.6Y alloy compared to 1 □m for W-10Cr-0.5Y alloy, which leads to the presence of defects with high binding energy for D, probably nanopores attached to the grain boundaries.
After saturation of the surface of W-11.4Cr-Y alloy and bare W with He, D retention is not much different. Moreover, the D retention after saturation of the surface with He weakly depends on the properties of bcc materials.

Primary author: Dr OGORODNIKOVA, Olga (National Research Nuclear University “MEPHI” (Moscow Engineering Physics Institute))

Presenter: Dr OGORODNIKOVA, Olga (National Research Nuclear University “MEPHI” (Moscow Engineering Physics Institute))

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