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Hydrogen diffusion, retention and irradiation-induced damage in fusion-relevant materials

Content

The suitability of the new class of materials called High Entropy Alloys (HEAs) as first wall for fusion reactors is studied. The most promising refractory HEA material MoNbTaVW, which is classified as a complex, concentrated alloy refractory metal is chosen for this study. Hydrogen isotope diffusion and trapping is studied using ion implantation, and TDS, SIMS, and ERDA techniques. The H isotope exchange in the HEA material (relating to diffusion and tritium removal) is studied using the annealing in hydrogen atmosphere method. Results show fast hydrogen diffusion at room temperature. D Implantation in WMoTaNbV does not seem to create additional hydrogen traps as happens in W. The majority of implanted D is retained in the bulk. Trapping energy of hydrogen in WMoTaNbV is about 1.7 eV for both D in the bulk and for D in the implantation profile close to surface. The hydrogen solution into WMoTaNbV might be exothermic (negative solution energy).

The second proposed task focusing on vacancy type defects formed in neutron irradiated W using PAS. We will receive the samples from SCK-CEN Belgium soon.

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