Investigation of the helium effects on deuterium retention in thin film lithium coatings on tungsten substrates

A.L. NEFF, J.P. ALLAIN, University of Illinois, Center for Plasma Material Interactions, Micro and Nanotechnology Center, Urbana, IL 61801, T.W. MORGAN, FOM Institute DIFFER-Dutch Institute for Fundamental Energy Research, Partner in the Trilateral Euregio Cluster, the Netherlands — In a burning fusion plasma, the materials on the walls of the plasma vessel will have a significant effect on the performance of the plasma. Any amount of high Z wall material that is eroded will contaminate and cool the plasma and may lead to a disruption. Additionally, if the material retains or reflects fuel it can affect the stability of the plasma. A high recycling wall that retains minimal fuel will allow better control of the fuel inventory, especially tritium, in the walls [1]. In contrast, a low recycling wall leads to improved plasma performance by preventing instabilities in the plasma [2]. We have observed that when 5% He is added to D ions during low flux ($10^{17} \text{m}^{-2}\text{s}^{-1}$) dual ion beam irradiation the amount of D retained in the Li film diminishes [3]. This conclusion is based on the reduction of a XPS peak (at 533 eV) associated with D retention in Li films [4]. To further investigate this phenomenon, we have continued the dual beam studies in IGNIS (Ion-Gas-Neutral Interactions with Surfaces) by varying the energy and concentration of He to D. Additionally, we exposed lithiated W to sequential D and He plasmas ($10^{24} \text{m}^{-2}\text{s}^{-1}$ flux) in Magnum PSI at DIFFER. With XPS, we analyzed the chemistry of the Li films and determined changes in retention. These results will be presented. [1] G. De Temmerman, et al., Nucl. Mater. Energy (In Press). [2] H.W. Kugel, et al., J. Nucl. Mater. 390–391 (2009) 1000–1004. [3] A.L. Neff, M.S. Thesis, Purdue Univ., 2013. [4] C.N. Taylor, et al., J. Appl. Phys. 109 (2011) 053306-053306-6.

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Anton Neff
University of Illinois

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