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Active control of high-Z material erosion in the DIII-D divertor[1]

R. DING, T. ABRAMS, J. GUTERL, H.Y. GUO, V.S. CHAN, P.B. SNYDER, GA, D.L. RUDAKOV, I. BYKOV, UCSD, W.R. WAMPLER, SNL, P.C. STANGEBY, J.D. ELDER, UTIAS, A.G. MCLEAN, LLNL — Dedicated DIII-D experiments coupled with modeling were carried out to understand and control high-Z material erosion in a mixed materials environment. The strong correlation of erosion with external biasing voltage suggested by modeling has been demonstrated in recent experiments. High carbon impurity concentration in the background plasma is also found to reduce the net erosion rate of high-Z materials due to increased carbon deposition in the surface. Both modeling and DIII-D experiments show that local methane injection can create a carbon coating on the metal surface. The carbon deposition provides information on radial transport due to E×B drift and cross field diffusion as well as background carbon concentration. Local deuterium gas injection upstream of the W sample reduces the W net erosion rate by a factor of 2 and increases the W re-deposition ratio, mainly due to local plasma perturbation.

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