

An experimental comparison of gross and net erosion of Mo in the DIII-D divertor

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Abstract

Experimental observation of net erosion of molybdenum being significantly reduced compared to gross erosion in the divertor of DIII-D is reported for well-controlled plasma conditions. For the first time, gross erosion rates were measured by both spectroscopic and non-spectroscopic methods. A net erosion rate of 0.73 ± 0.03 nm/s was measured using ion beam analysis (IBA) of a 1 cm diameter Mo-coated sample. For a 1 mm diameter Mo sample exposed at the same time the net erosion rate was higher at 1.31 nm/s. For the small sample redeposition is expected to be negligible thus comparison with the larger sample yielding a net to gross erosion estimate of $0.56 \pm 12\%$. The gross rate was also measured spectroscopically (386 nm MoI line) giving $2.45 \text{ nm/s} \pm \text{factor } 2$. The experiment was modeled with the REDEP/WBC erosion/redeposition code package coupled to the ITMC-DYN mixed-material code, with plasma conditions supplied by the OEDGE code using Langmuir probe data input. The code-calculated net/gross = 0.46, in good agreement with experiment.