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Suppressed gross erosion of high-temperature lithium films under high-flux deuterium bombardment[1] TYLER ABRAMS, M.A. JAWORSKI, R. KAITA, A.M. CAPECE, J.H. NICHOLS, D.P. STOTLER, PPPL, J.P. ROSZELL, Princeton U., G. DE TEMMERMAN, M.A. VAN DEN BERG, H.J. VAN DER MEIDEN, T.W. MORGAN, FOM-DIFFER — Liquid lithium is an attractive plasma facing component (PFC) for a fusion reactor because it improves confinement and protects the underlying substrate from high heat fluxes. However some previous studies have implied the maximum Li temperature permitted on such devices may be unacceptably low. Recently thin (<1 μm) and thick ($\sim$ 500 μm) Li films on TZM molybdenum substrates were studied in the Magnum-PSI linear plasma device with ion fluxes $>10^{24}$ m^{-2} s^{1} and Li surface temperatures $\leq$ 800 °C. Measured Li erosion yields under neon plasma bombardment were similar to previous studies on low-flux devices, but erosion under deuterium bombardment was significantly suppressed. This motivated development of a mixed-material Li-D surface model incorporating D diffusion in Li, preferential sputtering, and LiD chemistry. This model is coupled to the adatom-evaporation equation for thermally-enhanced sputtering and the Langmuir law evaporation equation to obtain realistic predictions of temperature-dependent erosion rates. This model is found to predict the correct functional dependence of the mixed-material Li-D erosion rate vs. temperature in these discharges. Further investigations via molecular dynamics (MD) simulations and surface science experiments will also be presented.

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