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Understanding plasma facing surfaces in magnetic fusion devices[1]
C.H. SKINNER, A.M. CAPECE, PPPL, B.E. KOEL, J.P. ROSZELL, Princeton University — The plasma-material interface is recognized to be the most critical challenge in the realization of fusion energy. Liquid metals offer a self-healing, renewable interface that bypasses present issues with solid, neutron-damaged materials such as tungsten. Lithium in particular has dramatically improved plasma performance in many tokamaks through a reduction of hydrogen recycling. However the detailed chemical composition and properties of the top few nm that interact with the plasma are often obscure. Surface analysis has proven to be a key tool in semiconductor processing and a new laboratory has been established at PPPL to apply surface science techniques to plasma facing materials. We have shown that lithiated PFC surfaces in tokamaks will likely be oxidized during the intershot interval. Present work is focused on deuterium uptake of solid and liquid metals for plasma density control and sub-micron scale wetting of liquid metals on their substrates. The long-term goal is to provide a material database for designing liquid metal plasma facing components for tokamaks such as National Spherical Torus Experiment-Upgrade (NSTX-U) and Fusion Nuclear Science Facility-ST (FNSF-ST).

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