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Plasma-wall interaction on the SLiC spherical tokamak device with large-area, dynamic liquid lithium free surface STEPHEN HOWARD, A. MOSSMAN, W. ZAWALSKI, D. FROESE, General Fusion — General Fusion is developing a magnetized target fusion system in which a spherical tokamak plasma target is injected by a magnetized Marshall gun into a flux conserver consisting of a liquid lithium vortex. A compression system will then collapse the cavity to compress and heat the target plasma to fusion conditions. We have recently commissioned a subscale experiment called SLiC (Spector Lithium Configuration) as way to de-risk both the engineering and the confinement physics in the situation where a moderately hot magnetized plasma must interact with a large-area free surface of liquid lithium. SLiC is similar in design to the sequence of compact, high-performing spherical tokamak SPECTOR devices that have been in operation at GF since 2016. In the first phase of experiments, ST plasmas were injected into a well-instrumented solid metal flux conserver with an annular liquid lithium puddle on the bottom of the vessel that had an angular coverage of 7 to 28 degrees (spherical polar angle) depending on puddle fill depth. A second phase of experiments, aiming to approach hemispherical coverage of liquid lithium, has extended the angular coverage to 78 degrees (polar angle) starting at the outboard equator going downward. This is done by applying an early current pulse that propels the liquid puddle outward to coat the flux conserver up to the equator in advance of the plasma formation. Interactions between the plasma and liquid free surface are studied with fast camera video and standard plasma diagnostics and used to validate corresponding MHD-CFD simulations.

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