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Self-Driven Liquid Lithium Target for High Heat Flux Handling[1]

STEVEN STEMMLEY, MATT SZOTT, DAVID RUZIC, University of Illinois at Urbana-Champaign — Liquid lithium has gained interest as a plasma facing material because of its ability to handle large heat and particle fluxes, reduce edge recycling, and increase plasma performance. In the past, the Liquid Metal Infused Trench (LiMIT) concept, developed at the University of Illinois, has been shown to work well under fusion relevant conditions. Recently, this concept has been extended to create compact, self-flowing liquid lithium targets for beam-target fusion neutron generators, which can produce heat fluxes on the order of 10's to 100's of MW/m^2. The liquid lithium surface acts as a self-healing plasma facing material and allows for the production of fusion relevant neutron spectra without tritium for materials testing by utilizing the Li-7(d,n) and D(d,n) reactions. Initial experiments, where a temperature gradient was imposed only via cooling, peak velocities of 16 4 cm/s were observed. For heat fluxes greater than 10 MW/m^2, COMSOL models have shown that sufficient velocities (~70 cm/s) are attainable to prevent significant lithium evaporation. Expected yields of this system would be 10^7 n/s for 13.5 MeV neutrons and 10^8 n/s for 2.45 MeV neutrons. Future work will be aimed at experimentally demonstrating the viability of these targets under large heat loads and determining the neutron output of the system. The preliminary results and discussion will be presented.

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