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A Compact Self-Driven Liquid Lithium Loop for Industrial Neutron Generation[1] STEVEN STEMMLEY, MATT SZOTT, KISHOR KALATHIPARAMBIL, CHISUNG AHN, Univ of Illinois - Urbana, BRIAN JURCZYK, Starfire Industries, DAVID RUZIC, Univ of Illinois - Urbana — A compact, closed liquid lithium loop has been developed at the University of Illinois to test and utilize the Li-7(d,n) reaction. The liquid metal loop is housed in a stainless steel trench module with embedded heating and cooling. The system was designed to handle large heat and particle fluxes for use in neutron generators as well as fusion devices, solely operating via thermo-electric MHD. The objectives of this project are two-fold, 1) produce a high energy, MeV-level, neutron source and 2) provide a self-healing, low Z, low recycling plasma facing component. The flowing volume will keep a fresh, clean, lithium surface allowing Li-7(d,n) reactions to occur as well as deuterium adsorption in the fluid, increasing the overall neutron output. Expected yields of this system are 10^7 n/s for 13.5 MeV neutrons and 10^8 n/s for 2.45 MeV neutrons. Previous work has shown that using a tapered trench design prevents dry out and allows for an increase in velocity of the fluid at the particle strike point. For heat fluxes on the order of 10's MW/m^2, COMSOL models have shown that high enough velocities (˜70 cm/s) are attainable to prevent significant lithium evaporation. Future work will be aimed at addressing wettability issues of lithium in the trenches, experimentally determine the velocities required to prevent dry out, and determine the neutron output of the system. The preliminary results and discussion will be presented.

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