HYDROGEN ABSORPTION IN LIQUID LITHIUM EXPOSED TO HYDROGEN PLASMA

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Plasma facing components (PFCs) created from flowing liquid metals with a small residence time could withstand higher heat loads than solid diverters. Self regeneration in continuous flowing of liquid metal PFCs avoids the challenge of having to replace eroded solid diverters. Liquid lithium's high heat capacity, low atomic number, and low sputtering yield make it a candidate material for flowing these advanced PFCs. However, little is known about interactions between flowing liquid lithium and energetic hydrogen ions. An understanding of hydrogen retention in flowing lithium is necessary before it can be used as a PFC because retention impacts the fuel recycling regime and tritium inventory.

The retention characteristics of lithium for both hydrogen (fuel loss) and helium (ash removal) are being measured at the University of Illinois' flowing lithium retention experiment (FLIRE) facility. In FLIRE a stream of liquid lithium can be exposed to a 2-7 kV DC hollow cathode discharge plasma before the stream is isolated in a separate chamber. There, prompt release of hydrogen and long term release (stimulated by heating) of hydrogen can be measured by magnetic sector residual gas analyzer.

Results of hydrogen absorption caused by plasma on flowing lithium are presented. Previous results have shown that flowing lithium exposed to neutral deuterium at pressures from P = 0.07mTorr to 1 Torr retains long-term concentrations of 0.1–0.2 percent deuterium. Initial data for deuterium plasma on flowing lithium showed an increase in long-term retention to 2–4 percent deuterium. These experiments have been repeated to confirm that deuterium plasma exposure increases retention of deuterium by lithium.