Hydrogen Isotopes Recovery from Liquid Lithium under Dynamic Conditions

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The use of D-Li stripping reaction to generate neutron is expected in the International Fusion Materials Irradiated Facility (IFMIF). Tritium generated by the reaction need to be recovered from liquid Li for safety. Tritium recovery by Y (yttrium) hot trap is expected as the effective purification system for the liquid Li loop. In IFMIF, liquid Li circulates in a loop, so it is important to trace tritium behavior in Y and liquid Li under dynamic condition. In this study, the authors inspected effectiveness of tritium recovery from liquid Li under dynamic conditions by Y hot trap.

In this study, hydrogen was used in place of tritium, and mass transfer behavior of hydrogen in liquid Li under dynamic conditions was investigated. The present authors set up experimental equipment including a mixer to stir liquid Li. The rotational speed of the mixer can be controlled from 10 [rpm] to 500 [rpm]. In this experiment, a Y plate (purity: 99.9%, thickness: 0.25mm) and Li (purity: 99.9%) was prepared as samples. An yttrium plate was put in a Mo reactor, and Li was put on the plate. The temperature of the reactor was controlled by an electric furnace (from 523 [K] to 573 [K]). Process gases containing hydrogen were introduced to the reactor, and the concentration of hydrogen at outlet of the reactor was measured with gas chromatography. We experimentally study the results under the conditions of stationary liquid Li and stirred liquid Li. In addition to the experiment, hydrogen absorption rate in the Li-Y system was simulated by numerical calculation. In this simulation, the rate-determining step of hydrogen transfer in Y and liquid Li is diffusion, and the overall mass-transfer coefficient is defined as parameter to estimate hydrogen absorption rate of Y from liquid Li. The overall mass-transfer coefficient is estimated by fitting the result of numerical calculation into the experimental result. Hydrogen absorption rate of Yttrium is evaluated quantitatively by the coefficient.