# §18. Integrated Experimental Process Study for Removal of Tritium and Impurities from Liquid Lithium, II

Fukada, S., Edao, Y. (Kyushu Univ.),
Tanaka, S., Suzuki, A. (Univ. Tokyo), Muroga, T.

Liquid Li is proposed not only for a self-cooled blanket material of a fusion reactor but also for a flowing liquid target called IFMIF to generate a high-energy neutron beam. Although Li has an advantage of the largest tritium (T)-breeding ratio (TBR) among all the blanket material candidates, T recovery from Li down to 1ppm which is the condition necessary for safety and economical standpoints of fusion reactors has not been proved experimentally. This is because the equilibrium pressure of T dissolved in Li is extremely low and therefore T recovery is affected by impurities involved in Li, especially oxygen. Y hot trap was proposed to recover T in Li lower than the necessary condition. However, T recovery down to 1ppm at 250°C is not experimentally proved previously, which condition is also demanded for IFMIF Li loop. Qualification criteria of T getter materials for Li purification are (i) to satisfy operating conditions of 250°C-300°C, (ii) to have high trapping capacity, (iii) to have high trapping kinetics and (iv) to make clear effects of cross-contamination. In order to make clear these issues, we conducted the experiment of Y hot trap for fusion reactor safety or IFMIF Li purification.

Three experiments described below have been conducted in the last fiscal year in the collaboration study among NIFS, Tokyo University and Kyushu University:

(1) Proof of Y recovery of H isotopes solved in static Li at the operating condition (250-300°C) demanded for IFMIF.
(2) Proof of Y recovery of low concentration T solved in static neutron-irradiated Li at 250-300°C.
(3) Proof of Y recovery of H isotopes solved in agitated Li at 250-300°C.

The results are shown in Fig. 1-3. **Fig. 1** shows that the HF-treatment of Y enhances the H absorption rate. This is because HF can remove oxide film formed on Y surfaces inevitably. **Fig. 2** shows that T of 0.1ppm included in n-irradiated Li is removed by HF-treated Y within limited time. **Fig. 3** shows the comparison of the effluent $H_2$ concentrations between the static Li-Y system (broken line) and the agitated Li-Y system (solid line). The effluent $H_2$ concentration for the agitated Li is lower than that for the static Li, and the $H_2$ recovery rate of around 5 times is realized under the condition of the stirred Li-Y system. The $H_2$ absorption rates in the case of stirring Li ($j_H$) are correlated in terms of the Re number ($\omega d^2/\nu$) and Sh number ($j_H d/D_{AB}$).

**Papers published in FY2008**

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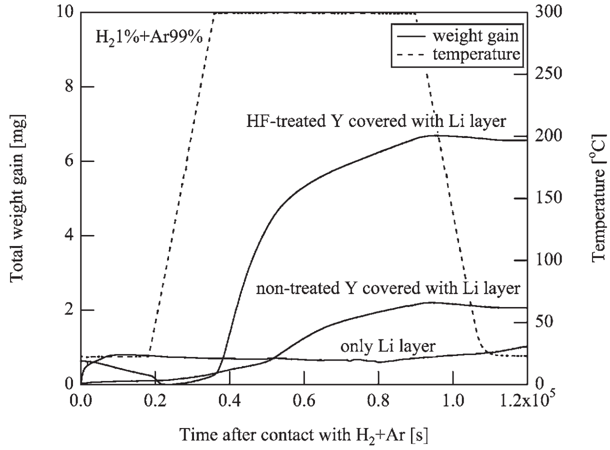


Fig. 1 $H_2$ absorption rate for three cases of Li-Y system

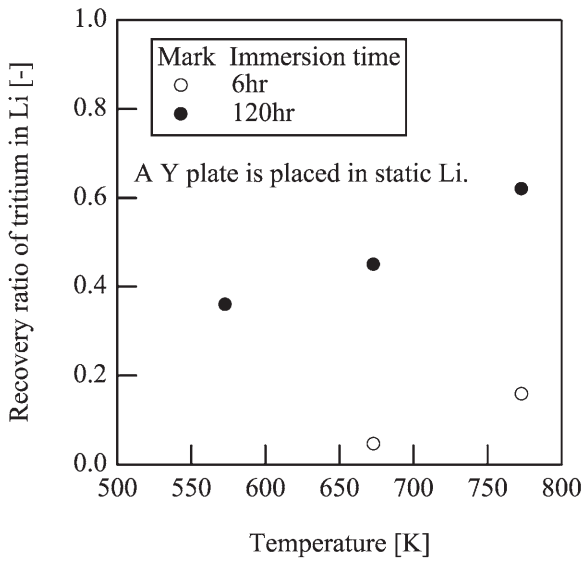


Fig. 2 Tritium recovery ratio from n-irradiated Li to HF-treated Y

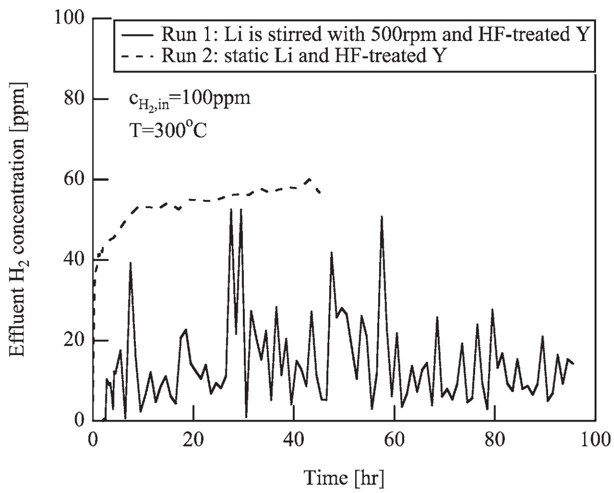


Fig. 3 $H_2$ absorption from stirred or non-stirred Li to Y