

Tritium Monitoring for Liquid Lithium by Permeation through Iron Wall

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Liquid lithium is not only a flowing target in IFMIF (International Fusion Reactor Material Irradiation Facility) but also a hopeful candidate as a tritium breeding coolant in a fusion reactor. Needless to say for tritium breeder, tritium is also generated by secondary reactions in IFMIF. Thus, tritium concentration in lithium must be monitored and controlled in the IFMIF and fusion reactors.

So far, quantifying permeation of hydrogen isotopes through an iron wall contacting with liquid lithium, hydrogen monitor has been developed and shown to have a good sensitivity for hydrogen and deuterium in lithium. Iron compounds such as oxide or nitride do not form on the lithium side (upstream) surface and are easily reduced on the downstream side surface, which is a promising character of iron permeation wall. Major dimensions of the permeation device are close to the figures shown in our previous work [1]. Some modification has been done for sweeping gas introduction.

In this study, controlling tritium concentration in lithium irradiating neutron in YATOI reactor of The Univ. of Tokyo, permeating tritium was quantified using ionization chambers. Major results acquired so far are as follows. (1) Measurable amount of tritium permeated the wall below 873 K for 1wppb of tritium in lithium. (2) Amount of tritium permeation and partial tritiated gas pressure was clearly affected by He gas sweeping rate for permeation wall. (3) Tritium permeation showed positive temperature dependence which will be caused by that of tritium distribution coefficient between iron and lithium. (4) Fixing temperature and He sweeping rate, tritium permeation showed nearly linear increase as tritium concentration increased.

In the manuscript and the conference, permeation decrease caused by surface oxidation and re-activation treatment effect will also be shown.

Reference

[1] J. Yagi et al., *Fusion Eng. Des.*, 84 (2009) 1993