FABRICATION AND OPERATION OF NITROGEN TRAPPING LOOP

FOR IFMIF-EVEDA

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Molten lithium is to be used in IFMIF as a flowing target for d-Li stripping reaction to generate neutron. During the operation of IFMIF, some amount of tritium is also generated by side reactions, which is estimated to be up to 7.4 g/year. For a safe operation, tritium in lithium is to be trapped by yttrium based on hot trapping method. However, yttrium is so reactive that it can also react with oxygen and nitrogen in lithium, which degrades trapping efficiency for hydrogen isotopes [1, 2]. Furthermore, such impurities in lithium enhance corrosion on structure material like austenitic steel. Oxygen in lithium can be decreased easily by a cold trapping method, however nitrogen must be decreased by hot trapping method. Fe-Ti alloy is a hopeful candidate for nitrogen trapping material [3] and nitrogen trapping experiment using Fe-Ti alloy is ongoing as a research in IFMIF-EVEDA. From a practical standpoint, the research needs to be performed under nonstatic condition and a nitrogen trapping loop, shown in the figure 1, has been fabricated in The University of Tokyo.

In the device, liquid lithium up to 1 L can be contained and circulated by a mechanical pump at several cm³/s and the temperature can be kept up to 873 K. As a trapping material Fe-5Ti or Fe-10Ti alloy pebble whose diameter is about 160 μ m is used to simulate future IFMIF-EVEDA loop condition. Small amount of lithium and trapping material is sampled out at specified time interval to quantify the nitrogen concentration in lithium and to investigate the state of trapping material. Operation result over 100 h will be shown in the manuscript and the conference.



Figure 1: Nitrogen Trapping Loop in Univ. Tokyo

[3] S. Hirakane et al., Fusion Eng. Des., 81, 2006, 665

^[1] S. Fukada et al., Fusion Eng. Des., 82, 2007, 2152

^[2] J. Yagi et al., ICFRM-14, 2009, P2 081