TRANSITION OF ERBIUM INTO Er_2O_3 AND $LiErO_2$ IN LIQUID LITHIUM

M. Nagura[1], A Suzuki[1] and T. Terai[1]

[1] *University of Tokyo*

Corresponding author: nagura@nuclear.jp

Self cooled Liquid Lithium (Li) blanket system is regarded as advanced blanket system for its high tritium breeding ration without neutron multiplier and high thermal conductivity. Recent researches for this blanket system are focused on MHD pressure drop and material corrosion. Insulating coating is considered as solution for MHD pressure drop. Erbium oxide (Er_2O_3) is candidate material for insulating coating because it has high thermodynamic stability and showed high compatibility with Li. However, previous research showed that Er_2O_3 forms slight amount of $LiErO_2$ in high temperature Li as a corrosion[1] and corrosion rate was affected by O concentration in Li[2]. Corrosion test with O trap was conducted[3] and it is shown that formation of $LiErO_2$ can be prevented by decreas O concentration in Li. These tests showed Er_2O_3 is stable in specific range of O concentration.

Transitions of Er, Er_2O_3 and $LiErO_2$ is controlled by O concentration in Li. Er is stable in extremely low O concentration and $LiErO_2$ is stable in higher O concentration such as several hundreds ppm. Er_2O_3 is stable under intermediate O concentration. This transition can be written as below.

$$2Er + 2Li + 4O(Li) \leftrightarrow Er_2O_3 + 2Li + O(Li) \leftrightarrow 2LiErO_2 \qquad (1)$$

However, thermodynamical data for $LiErO_2$ have not been investigated, therefore equibirium constant or kinetics constant is not investigated. In this paper transtion of Er into Er_2O_3 and $LiErO_2$ in Li is investigated.

The transition of Er into Er_2O_3 and $LiErO_2$ is conducted by immersing Er plate into Li, as shown in Figure.1. Mo crucible, in which Li and Er plate specimen was introduced, was sealed in a stainless steel container under Ar temperature. Then the container was heated by heater for test duration. Immersion temperature was upto 923 K and time was upto 500 h. O concentration of atomosphere was changed to investigate the influence of O concentration in Li. After the test duration, specimen was cleaned with ethanole, and transition was ovserved by SEM crosssection observation, XRD analysis and XPS.

The surface of specimen was oxidized and became Er_2O_3 in lower O concentration. On the other hand, $LiErO_2$ was observed on the Er_2O_3 by SEM for higher O concentration test. SEM cross section observataion of the specimen showed trantion of Er into Er_2O_3 and $LiErO_2$. The observation and XPS analysis indicated that transition rate depended on test temperature. The kinetics of the reaction was discussed in the paper.

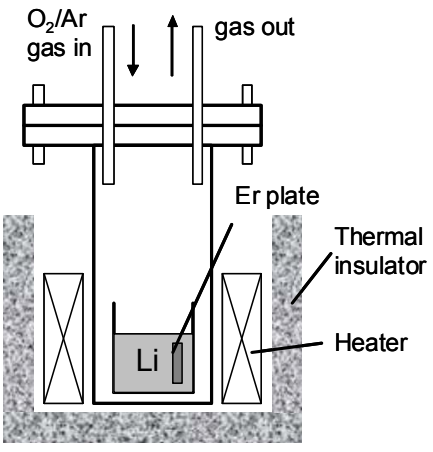

Figure.1 Equipment for immersion test of Er plate into Li.

[1] Masaru Nagura et al , Fusion Eng.Des., **84**(2009) 1384

[2] Masaru Nagura et al., Fusion Sci. Tech., **56**(2009) 841

[3] Masaru Nagura et al, ICFRM-14 abstract(2009) P3-139