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トリチウム増殖Li_4SiO_4–Li_2TiO_3混合セラミック材からのトリチウム回収挙動
Tritium recovery behavior for tritium breeder Li_4SiO_4 - Li_2TiO_3 mixture material

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1.Introduction

In the fusion reactor blanket, tritium is produced by (n, α) reaction with lithium. Solid lithium ceramic is considered as one of candidates for blanket materials. Especially, Li_2TiO_3 and Li_4SiO_4 are regarded as one of the advanced promising candidates due to relatively higher chemical stability and higher lithium atom density. Recently, Li_4SiO_4-Li_2TiO_3 mixture materials are proposed as advanced candidates, and several mechanical properties have been evaluated. However, the tritium recovery performance was not still understood. In this study, Li_4SiO_4-Li_2TiO_3 mixture materials with various phase ratios were used and their tritium desorption behavior after neutron irradiation was evaluated using tritium thermal desorption spectroscopy (TDS).

2.Experiment

Two kinds of samples with different phase ratios, namely Li_4SiO_4-Li_2TiO_3 (sample1) and Li_4SiO_4-$2Li_2TiO_3$ (sample2, sample3), were prepared. These materials were introduced into the Kyoto University Research reactor (KUR), and the neutron irradiation was performed with the fluence of ~ 8.0×10^{15} n cm^{-2} or 8.0×10^{16} n cm^{-2}. Thereafter, tritium TDS measurement was conducted at Shizuoka University from R.T. to 1113 K with the heating rates of 5 - 20 K min^{-1}.

3.Results and discussion

Figs. 1 and 2 show tritium TDS spectra for Li_4SiO_4-$2Li_2TiO_3$ samples with different neutron fluence. The peak temperature of sample2 was 506, 524, and 564K and that of sample3 was 572, 629 and 645K. Li_4SiO_4-$2Li_2TiO_3$ sample had single tritium desorption stage, their activation energy was evaluated to be 0.44 - 0.47 eV, which was almost consistent with Li_2TiO_3 sample. [1] The rate-determination step for tritium recovery can be explained by the diffusion-limited process. The effect of phase ratio also will be discussed in the presentation.

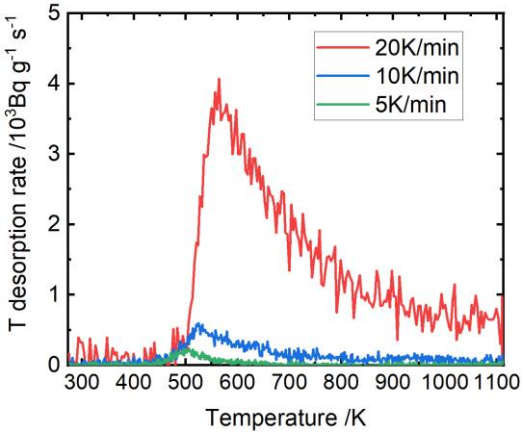

Fig. 1 Tritium TDS spectra for Li_4SiO_4-$2Li_2TiO_3$ samples with neutron fluence of 7.92×10^{16} n cm^{-2}. (sample2)

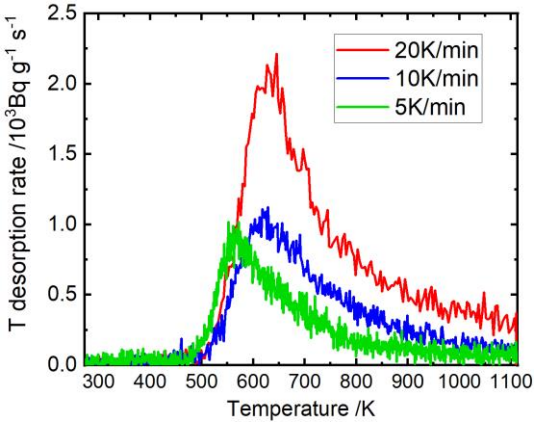

Fig. 2 Tritium TDS spectra for Li_4SiO_4-$2Li_2TiO_3$ samples with neutron fluence of 8.25×10^{15} n cm^{-2}. (sample3)

Reference

[1] Qilai Zhou et al., J. Nucl. Mater. 522 (2019) 286-293.