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A-FNSターゲット系機器に付着したリチウムと二酸化炭素との反応挙動
Reaction behavior of lithium adsorbed on A-FNS target component with carbon dioxide

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Introduction

For the development of IFMIF-relevant fusion neutron sources such as A-FNS and IFMIF/DONES, it is quite important to establish the stabilization technique for adhered Li on various devices or leaked Li into environment, and therefore it has been set as one of the R&D tasks in the IFMIF/EVEDA project during 2021 to 2025 [1,2].

In this study, the reaction of Li vapor with carbon dioxide and hydrogen isotope was evaluated and its reaction mechanism was discussed. At the initial stage, the reaction of Li vapor with carbon dioxide was focused.

Experimental

The Li reaction test device was developed at Shizuoka University. Li vapor was produced by heating above 523 K. Thereafter, various gas species can be introduction into the reaction chamber and produced gas species can be analyzed by a quadruple mass spectrometer (QMS). The small specimens (SS-316 or W) were also introduced into the reaction chamber for postmortem surface analysis by X-ray photoelectron spectroscopy (XPS).

Results and discussion

As a preliminary experiment, Li vapor was produced at 523 K for 4 hours and carbon dioxide was introduced into the reaction chamber with the pressure of 0.1 MPa. The reaction of Li with carbon dioxide was performed for one day. Thereafter, the residual gas analysis was performed by QMS. Fig. 1 show the result of mass spectrum. By comparison of Cracking pattern of carbon dioxide and air, major gas species was carbon dioxide. In addition, large amount of hydrogen was also observed, indicating that water or hydroxide adsorbed/absorbed in oxide layer on SS-316 would be released. Fig.2 shows XPS spectra for C 1s. Major chemical state of C was Carbide. But, additional small peak was found at 287 eV, showing the existence of carbonate on the surface.

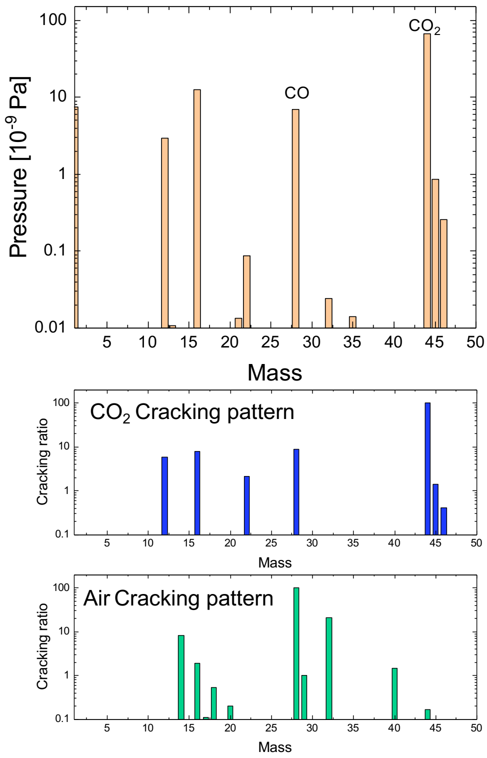

Fig. 1 Mass spectrum for gas in reaction chamber after Li-CO_2 reaction test

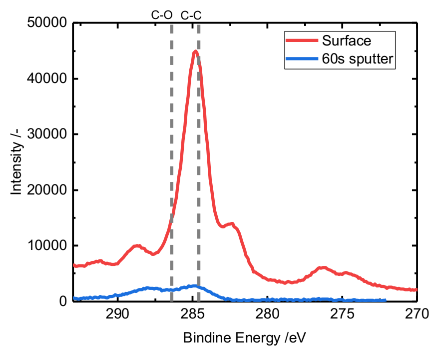

Fig. 2 XPS spectra of C 1s for SS-316.

References

[1] J. Knaster et al, *Nucl. Fusion* 57 (2017) 102016.
[2] P. Cara et al, presented at FEC 2021.