Compatibility between SiC and Li Ceramics for Solid Breeding Blanket System

S. Nogami, T. Murayama, Y. Nagata and A. Hasegawa
Dept. of Quantum Science and Energy Engr., Tohoku University, 6-6-01-2, Aramaki-aza-Aoba, 980-8579 Sendai, Japan
shuhei.nogami@qse.tohoku.ac.jp

Helium cooled solid breeder (HCSB) blanket using SiC/SiC composite as a structural material is one of the promising blanket design concept because of its high temperature operation and almost no-need to consider the effect of electromagnetic force and corrosion. There remain compatibility issues to be solved in the HCSB blanket, for example, compatibility between SiC and Li ceramics as a solid breeder, compatibility between SiC and Be and Be12Ti as a neutron multiplier, and compatibility between SiC/SiC and W as a first wall.

This study focuses on the compatibility between SiC and Li ceramics as a solid breeder. The open literature reported compatibility between these materials below 800\degree C. However, the HCSB blanket is expected to be operated above 800\degree C for high efficiency. The purpose of this study is to clarify the compatibility between SiC and Li ceramics at the temperature above 800\degree C.

Materials used in this study was CVD (chemical vapor deposition) processed β-SiC fabricated by Rohm and Haas and 4 kinds of sintered Li ceramics (LiAlO2, Li4SiO4, Li2ZrO3, Li2TiO3) fabricated by TYK Corp.. Specimens with φ3mm disc shape were stacked in an inconel tube capsule. This capsule was sorted in helium filled quartz tube. Heat treatment on this tube was carried out at the temperature of 900\degree C and 1000\degree C for 100 hours. Microstructural observation and compositional analysis of the contact surface and reaction phase were performed as a post heat treatment experiment.

Bonding between SiC and Li ceramics was not observed for all the experiment conditions. Adhering substance on the SiC surface, which was identified to be Li2SiO3 using XRD analysis, was observed for all the experiment conditions except for the SiC- LiAlO2 pair at 900\degree C. Reaction phase on the SiC surface was formed only in the SiC- Li4SiO4 pair at 1000\degree C. Compositional analysis of the reaction phase and effect of temperature on the formation of the adhering substance and reaction phase will be discussed.