

## Effect of high temperature ion irradiation on swelling and microstructure of Liquid Phase Sintering SiC

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SiC<sub>f</sub>/SiC composites are promising materials in nuclear energy system. Exploring the irradiation behavior of SiC matrix is of great importance. 3 kinds of SiC were irradiated up to 10dpa at 1200°C and then analyzed. The swelling induced by irradiation was lower than that of low temperature. The microstructure evolution was also revealed by SEM and TEM images.

**Keywords:** SiC, irradiation, swelling, TEM.

### 1.Introduction

In fusion and fission reactors, SiC<sub>f</sub>/SiC composites are attractive structure materials for their excellent properties in irradiation environments. For different reactors, the temperatures that structure materials suffer are diverse. With the increase of temperature, the mechanism of irradiation swelling goes through three stages, amorphization, point defect and void swelling. In previous research, the two stage swelling of liquid phase sintering (LPS)SiC at 300°C and 800°C has been measured. According to previous research for chemical vapor deposition (CVD) SiC, it could be assumed that the swelling at high temperature may change a lot compared with that of 300°C and 800°C. However, the irradiation behavior of sintering additives may influence total swelling. The objective of this research is to confirm that how the swelling of LPS SiC at high temperature changes from those of lower temperatures and analyze the microstructure evolution.

### 2.Experiment

In this research, CVD SiC, LPS SiC and LPS SiC-20vol%BN(20% vol BN particle dispersed LPS SiC) were irradiated at 1200°C with the doses of 0.1, 1, 3, 10 dpa. Al<sub>2</sub>O<sub>3</sub> and Y<sub>2</sub>O<sub>3</sub> were used as sintering additives for the LPS SiC. Irradiation induced swelling was calculated from the step-height of irradiated area measured by AFM (Atomic Force Microscope) morphology analysis. Surface morphology of these specimens was observed with SEM. In order to have a better understanding of the microstructure evolution of SiC after ion irradiation, thin foils were prepared with FIB and observed by TEM.

### 3.Results

The swelling was calculated from step height of the irradiated/unirradiated area boundary divided by irradiation depth. the amount of swelling of LPS SiC following 10 dpa irradiation were 1.2%, which are much lower than the swelling of the LPS SiC irradiated at 300°C (3.0% ) and 800°C (1.9%) even in the void swelling temperature range for SiC. The effect of sintering additives on the swelling was limited at 1200°C. SEM and TEM images of SiC grains and sintering additives (BN and YAG) will be displayed in the presentation.