7P74

室温照射によるSiC繊維微細組織の変化
Changes in microstructure of SiC fibers irradiated at room temperature

袁欣偉 1)、近藤創介 1)、余浩 1)、藪内聖皓 2）笠田竜太 1)
Xinwei Yuan 1), Sosuke Kondo 1), Hao Yu 1), Kiyohiro Yabuuchi 2), Ryuta Kasada, 1)

(1) 東北大学, (2) 京都大学
(1) Tohoku University, (2) Kyoto University

1. Introduction

SiC_f/SiC materials, owing to their low radioactivity and low neutron absorption, are considered to be one of the candidate materials for blankets in the fusion reactors. Because the strength of SiC_f/SiC composite is closely linked to SiC fiber strength, the irradiation behavior of fibers has been studied so far. The Hi-Nicalon Type S (HNLS), which is a widely used nuclear-grade SiC fiber in SiC_f/SiC, was shrunk after the irradiation at 300°C [1]. Although this is considered to modify the SiC_f/SiC strength, the mechanism of irradiation-induced shrinkage is still unknown. The shrinkage was suspected to relate to the diffusion of free C, which was initially found at SiC grain boundaries. The C diffusion may refer to two possible reasons, the high energy irradiation and the thermal effects. To know the contribution of the physical diffusion of C to the shrinkage, the SiC_f/SiC was irradiated at room temperature, at which C is almost immobile.

2. Experimental methods

The SiC_f/SiC composites studied were reinforced by highly crystalline Hi-Nicalon™ Type S (HNLS) and Tyranno™ SA 3rd fibers (TySA). The mechanically polished SiC_f/SiC composite surface was exposed to the 5.1 MeV Si ion beam to an average damage level of 100 dpa in the DuET facility at Kyoto University. The irradiation temperature was controlled to room temperature (≈ 30°C). The irradiated surface was studied by SEM and TEM.

3. Results

The surface morphology of HNLS fiber-reinforced SiC_f/SiC composite before and after irradiation is shown in Fig. 1. After irradiation, the fiber surface did not depress inward (shrinkage), instead expanded outward (swelling), as indicated by yellow arrows in Fig. 1b. Wavy folds (as indicated by green arrows) implied the swelling of the CVI matrix. The multilayered PyC/SiC interface

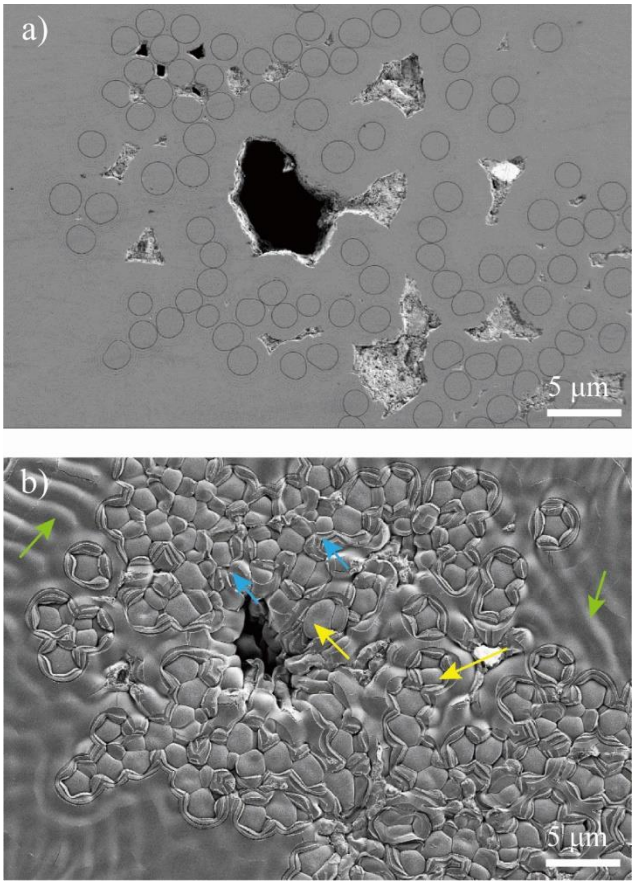

Fig. 1 Surface morphology of SiC_f/SiC reinforced by HNLS fibers (a) before and (b) after irradiation.

fractured after irradiation (as indicated by blue arrows). This may be due to the difference in swelling rate between each component. The microstructure observation results of fibers will be introduced and discussed in this symposium.

Reference

[1] Sosuke Kondo, et al. "Irradiation-induced shrinkage of highly crystalline SiC fibers." *Acta Materialia* 83 (2015): 1-9.