4 - 11 Study on Radiation Effect of SiC Fiber

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SiC fiber has been considered a reinforcement for nuclear systems because it do not react with base materials such as metals, ceramics, polymers under high temperature, and has excellent properties such as high hardness, wear resistance, high temperature resistance, corrosion resistance, oxidation resistance, low thermal expansion coefficient and heat conduction performance. It is necessary to study the performance of SiC fiber under irradiation.

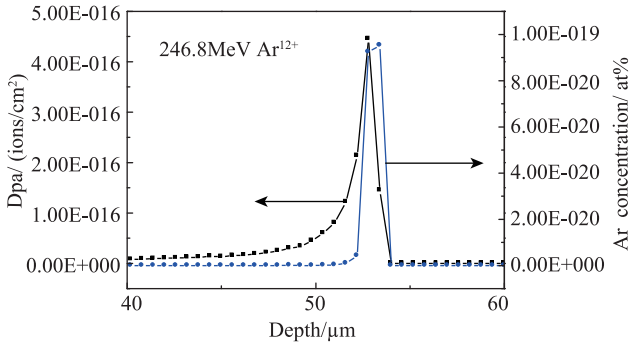

Fig. 1 Depth distribution of displacement damage and deposited Ar in SiC fiber, calculated by SRIM-2008.

The SRIM 2008 code was used to assess the damage induced in the material, as shown in Fig. 1. The displacement threshold energies for C and Si sublattices were, respectively equal to 20 and 35 eV[1]. Calculations show that 246.8 MeV Ar^{12+} ions have a projected range of about 52.8 μm in SiC fiber which is larger than the fiber diameter. The irradiation lead to a total fluence of 3.57×10^{16} ions/cm^2.

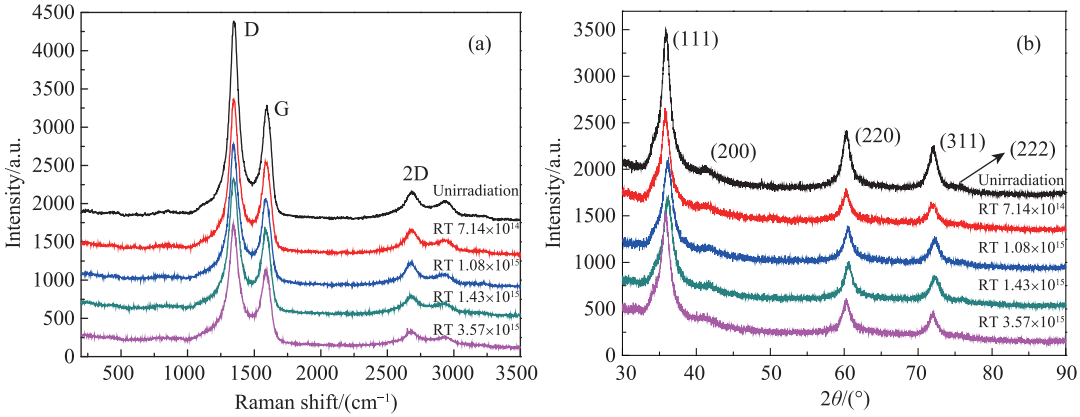

Fig. 2 (color online) Raman spectra and XRD spectra of irradiated and non-irradiated SiC fibers.

The Raman spectra presented in (Fig. 2(a)) give information related to the structural parameters of irradiated and non-irradiated fibers. According to Colomban[2] *et al.*, the two bands at 1 346 and 1 594 cm^{-1} are related to disordered carbon and correspond to the well-known D and G band constituents. The Raman spectra of irradiated fibers does not show an obvious evolution in comparison to non-irradiated one. This suggests that the local structure modification has not changed greatly. Fig. 2(b) shows XRD spectra of irradiated and non-irradiated SiC fibers. The main crystalline phase of all the fibers was β-SiC. The XRD spectra of irradiated fibers does not show an obvious evolution in comparison to non-irradiated one. Raman spectra and XRD spectra suggest that SiC fiber has better radiation resistance at the fluence of 3.57×10^{16} ions/cm^2.

References

[1] W. J. Weber, F. Gao, R. Devanathan, et al., Nucl. Instr. and Meth. B, 218(2004)68.

[2] P. Colomban, G. Gouadec, L. Mazerolles, Mater. Corros, 53(2002)306.