

X-Ray Diffraction and Precision Dilatometer Study of Neutron-Irradiated Nuclear Graphite Recovery Process up to 1673K

Authors : Yuhao Jin, Zhou Zhou, Katsumi Yoshida, Zhengcao Li, Tadashi Maruyama, Toyohiko Yano

Abstract : Four kinds of nuclear graphite, IG-110U, ETP-10, CX-2002U and IG-430U were neutron-irradiated at different fluences and temperatures, ranged from 1.38×10^{24} to 7.4×10^{25} n/m² ($E > 1.0$ MeV) at 473K, 573K and 673K. To take into account the disorder in the microstructure, such as stacking faults and anisotropic coherent lengths, the X-ray diffraction patterns were interpreted using a comprehensive structural model and a refinement program CARBONXS. The deduced structural parameters show the changes of lattice parameters, coherent lengths along the c-axis and the basal plane, and the degree of turbostratic disorder as a function of the irradiation dose. Our results reveal neutron irradiation effects on the microstructure and macroscopic dimension, which are consistent with previous work. The methodology used in this work enables the quantification of the damage on the microstructure of nuclear graphite induced by neutron irradiation.

Keywords : nuclear graphite, neutron irradiation, thermal annealing, recovery behavior, dimensional change, CARBONX, XRD analysis

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