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Microstructural Changes in PAN-based Carbon Fibers in Relation to Isothermal Oxidation

Seong-Moon Oh, Dong-Su Kang, Sang-Min Lee, Un-Gyeong Baek, Jae-Seung Roh
Kumoh National Institute of Technology
Daehakro 61, Gumi, Gyeongbuk, South Korea
smoh@kumoh.ac.kr; dsk@kumoh.ac.kr, dark2088@kumoh.ac.kr, me00900@naver.com, jsroh@kumoh.ac.kr

Extended Abstract

PAN-based carbon fibers are being increasingly used across industries due to their outstanding properties such as high strength, modulus of elasticity, and thermal conductivity [1-3]. However, some problems may occur when they are used at high temperatures exceeding 500℃ as carbon fibers break down into CO or CO_2, and this causes a deterioration of their physical properties [4]. With recent studies examining the mechanism behind carbon fiber activation, it is very important to have an accurate understanding of oxidation reactions [5,6]. In this study, PAN-based carbon fibers, widely used as C-C composites or reinforcement in CFRP, were selected for isothermal oxidation at 700℃ in air, and microstructural changes were observed in relation to oxidation reactions. The raw materials were Toray's T300 and T700. After removing sizing materials at 400℃ in a tube furnace, isothermal oxidation (air, 0.5L/min) was carried out at 700℃ over varying times. The surface and the cross-section of the isothermally oxidized materials were observed using a scanning electron microscope (SEM). The results revealed a decrease in diameter and a clear development of texture. In the case of 300, the furrows in the texture had grown further apart. Cross-sectional views showed that hollow sections had formed in the lengthwise direction, and this can be attributed to differences in crystallinity arising from the manufacturing and heat treatment process of carbon fibers.

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