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Memduh Kara, Muhammed Kirici, Ahmet Caner Tatar, Ahmet Avci

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Impact Behavior of Carbon Fiber/Epoxy Composite Tubes Reinforced with Multi-Walled Carbon Nanotubes at Cryogenic Environment

Memduh KARA[a], Muhammed KIRICI[b], Ahmet Caner TATAR[c], Ahmet AVCI[d]

[a] Corresponding Author, Mersin University, Engineering Faculty, Dept. of Mechanical Eng., 33343, Yenisehir, Mersin, Turkey, memduhkara@mersin.edu.tr , memduhkara33@gmail.com

[b]The Graduate School of Natural and Applied Science of Selçuk University, Dept. of Metall. and Materials Eng., Konya,Turkey, muhammedkirici.mk@gmail.com

[c]The Graduate School of Natural and Applied Science of Selçuk University, Dept. of Mechanical Eng., Konya,Turkey, ahmetcanertatar@gmail.com

[d]Selcuk University, Engineering Faculty, Dept. of Mechanical Eng., Konya, Turkey, aavci@selcuk.edu.tr

Abstract

This paper investigates the impact behaviors of filament wound carbon fiber/epoxy (CFRP) nanocomposite tubes at cryogenic temperatures. As nanofiller, multi-walled carbon nanotubes (MWCNT) were introduced to epoxy resin. $(\pm 55°)_4$ carbon fiber/epoxy nanocomposite specimens were manufactured using the filament winding method. Low velocity impact tests at 15 joule energy level were performed on the neat and MWCNT added CFRP tubes at different temperatures (23°C, 0°C, −50°C, −100°C, −196°C). The contact force-time, contact force-displacement histories and absorbed energy values by the specimens were obtained from the low velocity impact tests for each test samples. The effects of temperature change to impact response of neat and MWCNT added CFRP tubes were evaluated. Damage zones on the specimens were also examined in detail. It was observed that damages on the specimens increased when the temperature decreased for all test samples. Furthermore, the addition of nanoparticles to the specimens resulted in higher contact force values for the same temperature and less damage in the sample sections.

Keywords: Carbon-reinforced plastic, low-velocity impact, MWCNT, Cryogenic temperatures