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EFFECT OF IONIZING RADIATION ON CARBON NANOTUBE YARN

Evora, M.C.(1); Hiremath, N.(2); Lu, X.(2); Kang, N.(2); E Silva, L.A.(3); Bhat, G.(2); Mays, J.(2); Institute for Advanced Studies(1); University of Tennessee(2); University of Tennessee(3); University of Tennessee(4); Instituto de Pesquisas Energéticas e Nucleares(5); University of Tennessee(6); University of Tennessee(7);

Individual carbon nanotubes (CNTs) exhibit excellent mechanical, electrical and thermal properties, leading to development of a new generation of advanced lightweight materials and spacecraft electronics substituting the electronics based on silicon. Carbon nanotube yarn is developed to overcome the dispersion issues of pristine CNTs into liquids which is a limitation to combine with other materials. The direct assembly of CNTs into macroscopic fibers or sheets has been a way to overcome the dispersion process challenge. In this study, for a wide range of application of this material, we investigate effectively the defects on CNT yarns structure created by electron beam and gamma used as a source of ionizing radiation. The CNT yarns were irradiated at doses between 100 and 800 kGys and the effect of this irradiation on morphology and mechanical properties also were investigated completely. As a result, the resulting samples irradiated with electron beam at doses of 400, 600 and 800 kGy had a decrease in the strength from 251.09 ± 26.52 MPa for pristine to 108.86 ± 23.77, 153.15 ± 21.63, 170.50 ± 25.78 MPa respectively. The sample irradiated with gamma at dose of 100 kGy had no increase in the strength compared with pristine sample but had an increase in the elasticity modulus from 8.79 ± 1.19 to 19.63 ± 2.02 GPa, respectively. The quality of the CNT yarns that was gamma irradiated with absorbed dose of 100 kGy remains the same with improvement of 123% on the Young's modulus.