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Influence of carbon nanofiber and ionizing radiation on the morphology and properties of extruded polyacrylonitrile fiber

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Polyacrylonitrile (PAN) is an attractive precursor for carbon fiber production, providing high melting point and high carbon percentage fibers. Considering stabilization process a crucial step for carbon fiber (CF) manufacture, electron beam (EB) may be a tool to introduce cyclization of nitrile groups, crosslinking and chain scission in the PAN structure. Searching for differentiated precursor, a new material was developed based on polyacrylonitrile (PAN) and polystyrene (PS) copolymer reinforced with carbon nanofiber (CNF), and electron beam ionizing radiation was used to introduce changes in the sample structure and investigate the structure behavior when this new material was irradiated several doses up to 2000 kGy. The addition of 2% of CNF improved the elastic modulus of this new material by 125 % but there was no improvement in tensile strength results, which may be related to low fiber / matrix adhesion. The thermal behaviors of samples were investigated by thermogravimetric analysis (TGA). The main thermal degradation events occur between 235 oC and 400 ºC. The weight loss rate became slower when CNFs and irradiation were added to the fiber. Spectrometric changes in the mid infrared range were observed by Fourier transform infrared spectra (FT-IR).