PhD Thesis Title: Design and Construction of an active dosimetry based on Polystyrene - Carbon Nanotube Nanocomposite
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Abstract:

In this study, the COMSOL software was used to simulate the electrical properties of Polystyrene Nanocomposites-Multi-Walled Carbon Nanotubes (PS-MWCNT). The results of the simulation were compared and validated with the theoretical models and experimental articles, showed an acceptable correlation. In the experimental phase, the preparation of the nanocomposite was performed using mixed-solution in different weight fractions. The Scanning Electron Microscopy (SEM) images showed uniform distribution of nanotubes in the polymeric matrix. The silver paste was used on the films as electrodes. measurements of the electric charges during the specified time intervals and to determine the photocurrent in different dose rates by a two-probe method, at the first step by an electrometer. Then, an electronic circuit suitable for reading the dosimetry response of the nanocomposite was designed and constructed as a voltage variation in the output. In the irradiation process, ^{60}Co, ^{137}Cs and Theratron sources were used in the Secondary Standard Dosimetry Laboratory (SSDL) of Iran-Karaj. The results showed that this nanocomposite can to measure at low voltages of about 3 V. In the next experimental phase, the dose response for the dosimeter was measured using an array model. The results showed that the dual array of nanocomposites made with a triangular and single geometry has a higher sensitivity response at a wider interval dose rate. Also, this nanocomposite, as a dosimeter, exhibited a linear response at the range of 45-145 mGy/min. The precision of this dosimeter was obtained at the optimum voltage as 1 mGy/min approximately. Standard dosimeter characteristics to be considered for each dosimeter such as repeatability, dependence on the dosimeter response to the incident beam angle, dependence on the size of the radiation field, and long-term stability of the dosimeter response were investigated. At the end of the measurement, the dose-response of the dosimeter based on the nanocomposite was calibrated through the standard ionization chamber at the SSDL center of Iran-Karaj. Following the complete construction of the active dosimeter based on the PS-MWCNT nanocomposite and the implementation of the electronic components based on the CR-110 and digital programming of the system, the results showed that this device could be used as an active dosimeter for use in diagnostic and therapeutic dosimetry systems.

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2. **Mosayebi A**, Malekie S, Ziaie F. "A feasibility study of polystyrene/CNT nano-composite as a dosimeter for diagnostic and therapeutic purposes." Journal of Instrumentation. Volume 12, May 2017, P05012. DOI:10.1088/1748-0221/12/05/P05012

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