

Operational and Dosimetric Parameters of a 1.5 MeV electron beam irradiator in static and dynamic irradiation modes

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Electron beam (EB) accelerators have been increasingly used in radiation processing applications. Most aim to achieve reproducible chemical and biological effects on the irradiated material to preserve or modify its characteristics with tight control of the absorbed dose (10-100 kGy). Accurate dosimetry, mainly carried out with standard reference alanine dosimeters and cellulose triacetate (CTA) films, is essential to ensure the reliability of the whole process [1]. However, variations in the electron energy, beam profiles, attainable dose rate, and conveyor speed also affect the dose absorbed in the irradiated product, requiring constant control and monitoring of these parameters. This task is accomplished with passive dosimeters in static irradiation mode following the international standard recommendations. To broaden the quality control of the irradiation process, it has been proposed to investigate the feasibility of using a homemade diode-based dosimetry system to measure the electron beam profiles and monitor variations in the radiation field in an industrial EB accelerator (DC 1500/25/04JOB188) [2]. This innovative system, when implemented, can provide real-time data, enabling immediate action and avoiding unexpected shutdowns, thereby enhancing the efficiency of the process. The dosimetry probe comprises a commercial diode (230 μm thick; 7.0 mm^2 area), with the p^+ front pad connected to the Keithley 6517B electrometer in the short-circuit mode. In dynamic mode, irradiations are carried out by sending the probe through the radiation field in the conveyor direction, varying speeds from 2 to 10 m/min. For reference, static measurements are also gathered with alanine pellets and cellulose triacetate (CTA) films. Regardless of the irradiation modes and the dosimeter types, the beam profiles and dose measurements are in good agreement, as shown in Fig.1. The data reproducibility remains to be investigated.

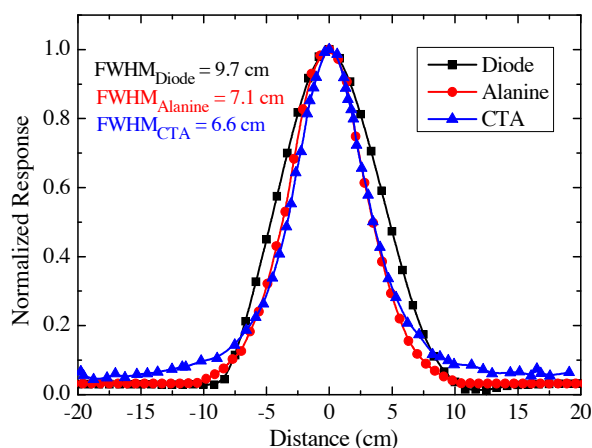


Fig.1. Scanned electron beam profiles gathered with the diode, alanine pellets, and CTA film dosimeters.

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References

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