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Review Paper

An Empirical Model for Predicting Harwell Dose Variation During Gamma Process Interruption Using Experimental Design

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Abstract
During routine dosimetry for radiation processing applications, process interruption is widely encountered; in this case dosimeters may receive their target dose in two or more absorbed-dose increments. Some interruptions may be planned, for example double side irradiations may be used to improve dose distribution. Other interruptions may be the result of unplanned irradiator shutdowns. In this case, dosimeters may be exposed to outside factors, such as temperature, without exposure to ionizing radiation. The responses of these dosimeters are usually influenced because the conditions in irradiation facilities may differ considerably from the conditions in which the dosimeters were calibrated. These differences may lead to expected systematic errors in dose estimation. An original approach is proposed in this work in order to simulate a process interruption within limits and quantify the effects of a combination of factors on dosimeter response using complete factorial design 2n . We present an in-depth experimental study on the response of dosimeters that have been irradiated, stored for a fixed period of time at several temperatures, and then re-irradiated. This study was performed using Harwell Red Perspex dosimeter type 4035.

Keywords
Dosimeter – Fractional dose – Experimental design – Harwell Red Perspex – Modeling