EPR characterization of thulium-yttria micro rods

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Introduction

Radiation dosimetry demands a continuos innovation in materials development. Yttria (Y2O3) exhibits intrinsic lattice features that enable doping with other rare-earth ions, resulting in improvement of its solid state characteristics. This work aims to evaluate the EPR response of thulium-yttria (YTm) rods containing 0.1at.%Tm (at.% atomic percentage of thulium) and formed by bio-prototyping.

Methods

YTm micro rods were irradiated with gamma (^{60}Co) doses from 0.001 to 150 kGy and evaluated by Electron Paramagnetic Resonance (EPR), with an X-band EPR, and at room temperature.

Results

According to results, YTm rods exhibited a linear dose-response behaviour in a range of dose from 0.001 to 1kGy. In addition, fading signal stability was achieved from 168h.

Conclusions

These findings indicate that thulium-yttria is a promising material for radiation dosimetry.

Online electron beam monitoring with a diode-based dosimetry system in routine quality control

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Introduction

The online response of a thin diode in electron beam processing dosimetry has previously been investigated. The main results are the linear dose response with sensitivity constant for doses up to 75 kGy and the stable dose rate response with repeatability ≤ 2.0 %. In line with these previous findings, this work aims to study the suitability of this dosimeter for measuring electron beam profiles and monitoring variations in the radiation field. Such information, essential for routine quality control, enables on-spot action avoiding unexpected shutdowns and increases in production costs.

Methods

The dosimetry probe consists of a diode (230 µm thick; 7.0 mm^2 area) in a light-tight case. Its p+ front pad is connected to the Keithley 6517B electrometer in the short-circuit mode. Irradiations are performed at a 1.5 MeV electron accelerator (DC 1500/25/04 – JOB 188) by sending the probe through the radiation field in the conveyor direction, varying speeds from 2 to 10 m/min. The electron beam is made to cover a width of 1m by magnetically scanning it at 100 Hz. Alanine dosimeters and cellulose triacetate (CTA) films are used for reference.

Results

Electron beam profiles are measured at different conveyor speeds and integration times of the electrometer. The best results are achieved at the highest conveyor speed (10 m/min) and the smallest integration time (0.05s). Under these conditions, the data gathered with the diodes agree with those assessed with alanine and CTA dosimeters. The dose readings during each diode pass underneath the beam coincide with the alanine measurements regardless of the integration times. The evaluation of the reproducibility parameter is underway.

Conclusions

Online beam profile and dose measurements performed with the diode agree well with those statically obtained with a reference alanine dosimeter. However, attention must be paid to setting the appropriate integration time at each conveyor speed to achieve the best profile resolution.