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Title of the abstract: Influence of eye lens dosimeter positioning in a realistic dosimetric phantom in reference radiation beams

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Abstract: The revision of the threshold dose for cataract induction by the ICRP in 2011 led to the adoption of a lower the annual dose limit recommendation and to the adoption of eye lens dosimetry worldwide. Various radiation dosimetry laboratories have adopted different solutions to Hp(3) monitoring regarding design and placement position on the head of each user (e.g. left/right eye, forehead, over/under glasses etc.). There is still no consensus on the ideal placement of the dosimeter, which contribute to deviations and uncertainties in the dose registered by the dosimeter in comparison to the "real" lens dose. In this work, additive manufacturing (3D printing) was used to produce a tissue equivalent "realistic eye dosimeter holder" with the same dimensions as the reference mathematical model used to obtain ISO kerma-to-Hp(3) coefficients. BeO optically stimulated dosimeters with near-tissue equivalence were placed in the position of the eye lens at 3 mm below the entrance surface of the eye. Two printed "realistic eye dosimeter holders" (RED-holders) were positioned in the left and right orbits of a skull filled with wax. Measurements on these RED-holders were taken as a reference values for comparison with commercial Hp(3) eye lens holders with BeO dosimeters placed on the left and right side of the head at eye height and forehead in between the eyes. Irradiations were made under ISO Narrow radiation qualities (24 to 164 keV) and S-Cs-137 (662 keV) and with angular irradiations ranging from 0° to +90°. Results for 0° frontal irradiations showed acceptable deviations (~15%) between reference values (REDs) and dosimeters worn at the left, right and forehead with a tendency to underestimate doses. As expected, the worse cases were observed when comparing angled irradiations where the commercial dosimeters were shielded or partially shielded by the head. In this case, reported values by the commercial dosimeters may underestimate lens doses by 55% at +30° and by 95% and +90°. The best placement for a single sensitive element dosimeter was the forehead placement, where 55% overestimation was observed between the highest dose lens (+90°) at some energies and 1500% overestimation with respect the lowest dose.

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Title of the abstract: Development of CaSO4:TR,Li (TR = Tm, Eu, Tb) composites for beta radiation dosimetry by means of luminescent techniques

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Abstract: The study of new dosimetric materials for investigations in ionizing radiation dosimetry is extremely important to provide sensitive and low-cost detectors. Thus, this work proposed the

development of CaSO4:Tm,Li, CaSO4:Tb,Li and CaSO4:Eu,Li composites for application in beta radiation dosimetry, using luminescent techniques such as thermoluminescence (TL) and optically stimulated luminescence (OSL). The CaSO4 crystals were produced by the adapted slow evaporation route and characterized using X-ray diffraction (XRD), radioluminescence, TL and OSL techniques. XRD analyses showed that the doped CaSO4 samples presented a single phase, with orthorhombic symmetry. The CaSO4:Eu,Li composites showed TL signals between 100°C and 200°C, with peaks around 145°C and 180°C. The CaSO4:Tb,Li and CaSO4:Tm,Li composites showed TL signals between 100 °C and 350 °C, with peaks around 165 °C and 275 °C. All samples were irradiated with a 90Sr/90Y source from the TL/OSL Risø reader. For the CaSO4:Tb and CaSO4:Tm samples, the addition of lithium as co-dopant resulted into a significant increase (2x) in the total TL signal of the samples. The CaSO4:Tm,Li samples presented a very intense OSL signal, about 80x greater than the signal of the other samples produced. This allows the applicability of TL/OSL detectors even more sensitives. The OSL decay of the CaSO4:Eu,Li and CaSO4:Tb,Li samples is dominated by a fast decay while the OSL signal of CaSO4:Tm,Li composites decays slowly and remains stored for a long time. The TL emission spectra of the samples showed typical emissions of Eu2+ ions (280 nm), Eu3+ (614 nm), Tb3+ (544 nm) and Tm3+ (455 nm). As no emission corresponding to lithium was identified in the emission spectra, it can be assumed that lithium acts as a capture center and transfers its energy to the nearby TR3+, which increases the emission intensity. All the samples produced showed linearity in the dose range used, good reproducibility, with variations below 10%, and minimum detectable doses of the order of micrograys. The evaluated dosimetric characteristics denote that the developed composites have potential application as TL/OSL dosimeters.

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Title of the abstract: Potential of red thermoluminescence of surface mount resistors from smartphones for retrospective dosimetry

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Abstract: There is a high scientific interest in using personal items as emergency dosimeters and smartphones, being extremely widespread and carried along wherever people go, seems to be a particularly useful object in this context. Of the different components of mobile phones that have been studied, the alumina substrate of surface mount resistors (SMRs) found on the circuit board seems to be most promising material when readout using OSL, in terms of sensitivity, low intrinsic background and homogeneity of fading characteristics. One of the drawbacks is however the need to sample at least 10 resistors for a dose assessment. This implies destruction of the smartphone and modern phones tend to have fewer and fewer resistors. In this work the potential of the red TL of SMRs is investigated for retrospective dosimetry to overcome these issues. This emission is due to the Cr(3+) impurity and shows an intensity that surpasses the intensity of the blue emission by up to two orders of magnitude. This dramatic increase in sensitivity enables the dose assessment on a single resistor when using a red sensitive PMT. Samples from different phones were characterized according to dose response, detection limit, intra-sample and inter-sample variation in intrinsic background and fading. Irradiation trials on intact smartphones demonstrated that dose assessment down to 20 mGy is possible at the single resistor level, up to 30 days after exposure.

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Title of the abstract: Evaluation of TL and OSL responses of recycled crab shell biowaste for radiation dosimetry