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LiF:Mg,Cu,P FOR ALPHA RADIATION DETECTION USING THE TSEE TECHNIQUE

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Introduction Thermally Stimulated Exoelectron Emission (TSEE) is a technique that can be used to measure weakly penetrating radiations such as alpha and beta particles and low energy X radiation, due to the shallow surface region within which exoelectrons originate. In this work, sintered pellets of LiF:Mg,Cu,P were used to study the possibility of their use for the detection of alpha radiation.

Materials and Methods LiF:Mg,Cu,P sintered pellets with 4.5 mm in diameter and 0.8 mm in thickness, GR200A (gently donated by Dr.D.F.Regulla,GSF,Germany),were used for this work. The samples were submitted to alpha radiation (^{241}Am sources) from a secondary standard system in the range from 3.5 to 8.2×10^4 s^{-1} of emission flux. A 2π windowless proportional counter with hemispherical volume and P-10 gas flow (10% Methane + 10% Argon) and an operating high voltage of 2.0 kV was used for the samples'readout. The glow curves were recorded in a multichannel scaler (EG&G - Ortec ACE-MCS SN 363 plug-in-card).

Results The glow curves of the LiF:Mg,Cu,P sintered pellets irradiated with an ^{241}Am source with an emission flux of 3601 s^{-1} for ten minutes, presented the main glow peak at about 200 °C. The reproducibility of the TSEE response was obtained measuring them 10 times after repeated standard annealing and irradiation procedures. The standard deviation was lower then 8.0%. The TSEE response as a function of irradiation time and emission flux was also measured, showing linear behaviors.

Conclusion The preliminary results obtained on some dosimetric characteristics as reproducibility, adequate glow peak temperature and calibration curves of the LiF:Mg,Cu,P sintered pellets indicate that they can be useful for alpha radiation detection using the TSEE technique.

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An Evaluation of Commercial Epoxy Resin Phantom Materials in Dosimetry

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Introduction: The use of epoxy resin solid water phantoms is becoming increasingly common for dosimetry purposes. Information on their behaviour is partly available in the literature but there are different mixes and formulations often given similar names and it is not appropriate to transfer information from one material to another.

Materials and Methods: Four commercially available water substitute materials have been evaluated for use in megavoltage photon and electron beams and also in kilovoltage x-ray beams. They are the original White formulation, WT1, and a development of this to produce an electron beam formulation, WTe, both of which are available commercially from Radiation Physics at St. Bartholomew's Hospital , London; and two plastics produced by RMI, Wisconsin, the original 'solid water' mix, RMI 451, and the later version which replaced it, RMI 457. A number of independent experimental techniques have been employed with reproducible results. Results have been determined for electron beams ranging in nominal energy from 5MeV to 20MeV, for megavoltage photon beams of nominal qualities of cobalt-60, 4MV, 6MV, 9MV and 16MV, and also for a kilovoltage energy of 300kV.

Results and Conclusions: For electron beams fluence ratios of water to solid water for WTe and RMI 457 have been determined at the depth of maximum dose and have been found to be linearly dependent on the mean electron beam energy at the depth of measurement. For the WTe the fluence ratios vary from 1.002 at an $\bar{E}_d$ of 3MeV to 0.993 at an $\bar{E}_d$ of 14MeV and for RMI 457 the respective fluence ratios vary from 1.012 to 0.995. The depth ionisation curves measured in the respective solid water materials are shown to be in agreement with those measured in water within the limits of measuring uncertainty. For megavoltage photon beams the results indicate that an assumption of unity for the phantom correction factors of epoxy resin phantom materials may introduce a systematic uncertainty of the order of 1%, dependent upon both the beam quality and the actual epoxy resin phantom material used. Furthermore it can be stated that the newer formulations, WTe and RMI 457, developed for electron beam use, are also closer to water for use in the routine calibration of megavoltage photon units.