AbstractID: 5286 Title: Energy Response of a CR Plate exposed to Megavoltage X-ray and Electron beams

Purpose: To investigate the mechanism underlying the energy dependence when a CR plate is exposed to therapeutic beams.
Method and Materials: Small circular disks were cut from one CR plate and placed in a water-equivalent plastic (WEP) phantom and exposed. The photostimulated luminescence (PSL) signal was recorded until the signal dropped to the background level to obtain the bleaching curve (PSL vs. time). The area under the bleaching curve (AUC) gives a measure of stored information in the CR plate. Monte Carlo simulations were used to obtain the ratio, D_{CR}/D_{Water} of the energy absorbed in the active layer of the CR plate in a WEP phantom to the energy absorbed in water when the entire phantom (including the CR plate) is replaced by water.
Results: For electron beams, the AUC was independent of energy for any given dose to water, and the work function, W, i.e. the energy required to produce one PSL photon was also energy independent. In contrast, for photon beams, the AUC was 15% and 30% higher for 18 MV than for 6MV and Co-60, respectively where the ratio D_{CR}/D_{Water} was 0.81, 1.08 and 1.11, respectively. Taking AUC data into account, the W for 18 MV had to be lower than for 6MV and Co-60, our data showing 37% and 45%, respectively, in order to give a higher AUC despite a lower energy absorption in the active layer. While there is no obvious reason for this energy dependence, the differences in the secondary electron spectra produced by the different photon beams are probably not responsible.
Conclusion: The method presented here will help researchers to both understand the response to ionizing radiation and develop new applications such as megavoltage dosimetry for IMRT verification. The energy dependence of W on beam modalities requires caution regarding CR dosimetry.