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X-ray spectroscopy in mammography with a silicon PIN photodiode with application to the measurement of tube voltage

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ABSTRACTS

In this work a silicon PIN photodiode was employed in mammographic x-ray spectroscopy under clinical and nonclinical conditions. Measurements have been performed at a constant potential tungsten anode tube, adapted in this work with molybdenum filters to produce a beam like that used in mammography, and at a clinical equipment with a molybdenum anode tube by using an additional aluminum filtration. The corrected x-ray spectra were in full agreement with those generated by theoretical models published in the literature and agree well with those measured with a CdZnTe detector for tube voltages less than 30 kV. The half value layer and the relative exposure values calculated from the corrected silicon PIN photodiode spectra were in agreement with those measured with an ionization chamber. These results indicate that a silicon PIN photodiode are very suitable for mammographic x-ray spectroscopy. As an application, the voltage (kV) applied to mammographic x-ray equipment has been measured through the evaluation of the spectra high energy cut off. Uncertainties evaluated for the voltage values calculated from the measured spectra are less than 0.13% for voltages in the range 20–35 kV. The low uncertainties associated with the obtained results in this work point out that the method employed can be accurately used for calibration of noninvasive mammographic kV*p* meters.