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Application of Silicon-Polymer composite varistors to protect sensitive medical imaging circuits and performing better voltage bias for SiPMs

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Nowadays Silicon photomultipliers (SiPM) becomes a reasonable choice for time of flights Positron emission tomography(TOF-PET). To achieve the best performance of SiPMs, it is necessary to adjust a suitable voltage bias; this means that SiPMs are very sensitive to voltage fluctuations [1]. One of the most significant issues in electronic circuits related to medical imaging equipments is finding a way to protect them against voltage fluctuations. The common method is using voltage dependent resistors which is called varistors [1]. The resistivity of a varistor decreases extremely at the specific voltage called Breakdown voltage. Also this electronic piece can save circuit from voltage damages by diverting surge current to an external circuit. [2, 3]. Silicon-polymer composite varistors, which were prepared using hot press method at a temperature of 130°C and a pressure of 60 MP, have been investigated. Research on (I-V) characteristics of samples shows that by increasing Silicon content in the mixture, the breakdown voltage decreases from 110V to 70V, but leakage current increases. Increasing Silicon content decreases their potential barrier height also from 0.29 eV to 0.26 eV. Unlike breakdown voltage and potential barrier height, increasing Silicon content increases nonlinear coefficient from 4.1 to 4.8. Using these techniques give us ability to produce suitable varistors for medical imaging modalities.

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