

Influence of CdTe material ageing on relaxation time and noise

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Because direct band gap and high atom number, Cadmium Telluride based detectors are promising for next generation of radiodiagnostic devices. In present manufacturing technology, the compensation of deep levels is not satisfactory solid. Presence of deep levels leads to charge trapping in detectors bulk. The effect of charge trapping is inferior charge collection in contacts area and deteriorated spectral resolution of detector. Impacts of the all mentioned phenomena on detector properties increase with detector age. To describe this, the analysis of detector relaxation time, together with noise spectral density evaluation, is used in this paper. For this purpose, we analyzed high-ohmic indium doped P type sample with gold contacts, prepared by chemical deposition of aqueous solution of AuCl_3 . The simulation of ageing process was carried by storing analyzed sample at temperature 100°C . After application of this process, the relaxation time of detector increased from order of hundreds seconds to 10^4 seconds. During the relaxation process, low frequency noise was observed. We found two stages of noise behaviour. Immediately after biasing, Noise spectrum has monotonous $1/f$ behaviour with parameter $m = 1.3$ among the whole frequency range. At time 300 seconds after biasing, the decrease of detector resistivity became less abrupt. Another shape of spectrum was observed. At low frequencies below 3Hz, the m parameter was 0.3 that is close to thermal noise behaviour. The rest of noise spectrum remained the same value of $m = 1.3$. During abrupt change of detector current, after biasing, the magnitude of noise spectral density was $10^{-7} \text{ V}^2/\text{s}$. In time region more than 300 s after biasing, the magnitude of noise spectral density dropped to $10^{-8} \text{ V}^2/\text{s}$ and remained constant for the rest of relaxation process that lasted for 10 000 seconds. From our measurements, we found that in first 300 seconds after biasing of aged sample, deep level filling by charge carriers takes important role in transport mechanism.

Author: Mr SIK, Ondrej (postgradual student)

Co-authors: Dr ANDREEV, Alexey (Scientist); Dr EDUARD, Belas (Assoc. Professor); Prof. SIKULA, Josef (Professor); Prof. GRMELA, Lubomir (department CEO)

Presenter: Mr SIK, Ondrej (postgradual student)

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