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Utilization of a pnCCD detector for Synchrotron radiation experiments: Application study of Interdiffusion in Metallic Thin Films

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Developments in synchrotron radiation facilities have provided photon fluxes in the order of 1014 photons/sec and higher. To utilize such high fluxes in particular experiments it is important to provide detectors that handle such fluxes, operate with fast frame rates and resolve at the same time events in the spatial coordinates with reasonable energy resolution.
This study characterizes a pn-CCD pixel detector [1] as a function of high photon fluxes and high frame rates. Experimentally, different photon rates, faster charge transfer clocking and different frame rates were probed and the validity of delivered data was studied. For low photon rates the concept the detector is operating in the single photon detection. However, for higher count rates this concept does not work anymore but alternatively the detector can operate in so called integration mode. For this type of applications it is necessary to investigate the full well capacitance of the detector pixels.
As instructive example of application of pnCCD we present in-situ studies of thermally induced inter diffusion in thin Fe/Pt multilayer films [2]. Such kind of applications produces distinguished structural peaks (Bragg reflections) with a high local intensity and characteristics that change as a function of time and temperatures. Here the particular advantage of the energy dispersive detector is to perform measurements simultaneous over a wide energy band including characteristic L-absorption edges of Pt. This allows for determination of element specific interdiffusion. The experiments performed were used to build-up a model for the detector response under high fluxes and increasing frame rates.

[1] N. Meidinger et al., Nucl. Instr. and Meth. A, 2006, 565, 251-258
[2] N. Zotov, J. Feydt, A. Savan and A. Ludwig, Journal of App. Physics 100, 073517 (2006).

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