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Use of Hydrogenated Amorphous Silicon to precisely measure X-ray fluxes

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Hydrogenated amorphous silicon has been used since many years in the fabrication of devices related to opto-electronics, such as solar cells, thin-film transistors and other applications. To obtain a detector grade device it is necessary to reduce the number of dangling bonds inside the material by introducing hydrogen into the material to passivate them. 10-14% is the typical value of hydrogen content to obtain a detector grade device that is highly resistant to ionizing radiation damage due to its intrinsic disordered nature.
The research program of the INFN HASPIDE project aim to develop a-Si:H devices for ionizing beam characterization, space radiation measurements and neutron detection.

This talk will describe the fabrication details of the a-Si:H devices, the characterization methods and some results obtained so far for X-ray beam measurement, for different sources: clinical LINACs, laboratory X-ray beams, synchrotron radiation.
The linearity of the response with respect to dose-rate is about 1-2 %, sensitivity and noise are comparable to diamond devices, variability of samples from the same production batch is smaller than 10%.
The PECVD techniques (temperature in 150-300 ℃) allow the deposition of thin layers of material (few micrometers) on a variety of substrates, among which also thin layers of plastic materials. Hence it will be discussed also the possibility of transmission detectors for different
applications: instrumented flange at the vacuum/air separation of charged particle accelerators, transmission detectors for dosimetry of real dose delivered to patients by clinical beams in radiotherapy.

Summary

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