Ion microprobe investigation of advanced radiation detectors for future accelerator facilities

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Semiconductor radiation detectors intended to be used in future accelerator facilities have often very specific requirements in terms of radiation hardness, spectroscopic quality, timing properties and spatial sensitivity. The ion microprobe technique IBIC (Ion Beam Induced Charge) provides important information about most of these detector properties in a rather simple and fast way. It utilizes the fact that high spatial resolution microprobe systems coupled to a tandem accelerator facility, can provide a variety of ion species, their respective energies and wide range of beam currents, enabling in such a way characterization of different detector properties.

Two ion microprobes of the RBI have been in recent years further upgraded and subsequently used for characterization of a wide range of different detector systems. In this presentation we concentrate to those detector prototypes where IBIC provided unique information that cannot be obtained by other, more conventional, detector characterization techniques (e.g. laser TCT). In the case of scCVD diamond detectors intended to be used as a beam micro-loss monitors at IFMIF DONES accelerator, the crucial advantage of the RBI microprobe setup, being capable to do IBIC tests at low temperatures, has been utilized to characterize the decrease of diamond detector response at temperatures below 100 K [1]. In the case of LGAD detectors, for prototypes intended to be used in the next generation of CERN experiments, the capability of IBIC to characterize detector response in three dimensions has been demonstrated [2]. These and other application examples of IBIC will be presented in the view of present and future upgrades of the RBI accelerator facility.

References

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