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SiCILIA ,Silicon Carbide detectors for Intense Luminosity Investigations and Applications

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Silicon carbide (SiC) is one of the compound semiconductor which has been considered as a potential alternative to Silicon for the realization of charge particles detectors and dosimeters in high energy physics. The chemical and physical material properties are promising for high temperature and high radiation operation conditions [1]. The potential application of SiC as radiation hard material for detectors implementation and the possible use in several new INFN projects (NUMEN,NuReLP, ELIMED, FAZIA etc.) have led to the birth of a cooperation between INFN and IMM-CNR for a common RD; activity on Silicon Carbide technology named SiCILIA (Silicon Carbide detectors for Intense Luminosity Investigations and Applications) which has been totally funded by INFN.
SiC diodes are predicted to be radiation harder than Si due to the high displacement threshold and potentially used as detectors in high radiation conditions. The remarkable progresses in the material growth process [2] and device technology of the last years, allowed to realize high performances SiC devices based on p-n junction [4].
For nuclear community is very important the realization of detection system that can operate with high fluxes (107 pps/m2) and fluences (1014 cm-2) of heavy-ions in order to determine the cross sections of very rare phenomena (i.e. such as double charge exchange reactions). Silicon carbide technology offers today an ideal response to such challenges, since it gives the opportunity to cope the excellent properties of silicon detectors (resolution, efficiency, linearity, compactness) with a much larger radiation hardness (up to five orders of magnitude for heavy ions [5]), thermal stability and insensitivity to visible light.
In the framework of SiCILIA activities, several measurements have been performed on SiC prototypes, by using radioactive source and ions beams. In this contribution we discuss on the main results of these activities (material properties, fabrication processes, energy resolution, charge collection efficiency, radiation hardness, etc) comparing also the SiC performance with that of a standard Silicon detector.

References

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Selected session

Accelerators and Instrumentation

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