Evaluation of ion induced damage on semiconductor devices using focussed ion beams

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The extent of radiation damage induced by MeV ions in semiconductor rectifying devices has been studied by measuring the progressive reduction of the ion beam induced charge collection response. This research is aimed to formulate an experimental procedure able to provide a quantitative characterisation of the damage produced by MeV ions at low fluences.

The experiment was performed by measuring charge pulse height signals produced by proton beams focussed in a selected region of a 4H-SiC epitaxial Schottky diode, following the experimental procedure proposed by Nipoti *et al.* [1]. The samples were irradiated at different proton energies and the pulse signals were recorded at different applied bias voltages in order to probe different depths of the active regions by considering different energy loss profiles and different extensions of the depletion layer.

Assuming that at low fluences the damage is produced only by the creation of vacancy/interstitial pairs, whose density profile can be calculated by the SRIM code, we have interpreted the charge pulse height curves as a function of cumulative ion irradiation on the basis of the Shockley-Ramo-Gunn formalism [2], which has to be considered as a rigorous extension of the basic concepts described in the pioneeristic work of Breese [3].

Finally the fitting algorithm allowed us to estimate the concentration of active trap centers and to provide a quantitative evaluation of the radiation hardness of the material.

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