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Lateral IBIC analysis of GaAs Schottky diodes

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Abstract

Charge collection efficiency (CCE) profiles of a semi-insulating (SI) gallium arsenide LEC (Liquid Encapsulated Czochralski) Schottky diode have been investigated by lateral Ion Beam Induced Charge collection (IBIC) technique. A focussed 2.4 MeV proton microbeam was scanned over the cleaved surface of a SI-GaAs diode and the charge collection efficiency was evaluated as a function of the ion beam position at different bias voltages.

By fitting the CCE profiles with the equations derived by the Shockley–Ramo–Gunn's theorem, drift lengths of electrons and holes were obtained. Experimental results are consistent with previous OBIC (Optical Beam Induced Current) and SP (Surface Potential) measurements and confirm the model based on the formation of a Mott barrier due to the enhanced electron capture cross section in high field conditions.

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Keywords: GaAs Schottky diodes; Ion beam induced charge collection; Ramo's theorem

1. Introduction

Extensive studies have been performed in past years to characterize semi-insulating (SI) gallium arsenide (GaAs) Schottky diodes employed as ionising radiation detectors. Although the interest for applications of these devices in high energy physics experiments gradually declined due to the

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