Seminar

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ION BEAM TESTING OF ADVANCED FUNCTIONAL ELECTRONIC DEVICES

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Abstract

We present ANSTO's accelerator capabilities for the high-precision testing of advanced functional electronic devices: the SIRIUS nuclear microprobe, the ANTARES heavy-ion external microprobe, and the synchrotron XRF beamline. As examples we will present test results obtained with i) SOI based devices for radiation dosimetry at the cellular scale (microdosimeters), ii) radiation-hardened SRAM chips fabricated in CMOS technology, and ii) commercial off the shelf ICs.

Ion Beam Induced Charge (IBIC) microscopy has been used as the indispensable accelerator technique for testing and optimisation of SOI devices' configuration and operating electronic conditions to achieve the best possible radiation detection properties with sensitivity on a micrometre scale. We achieved close to ideal CCE equal to 1 with no cross-talk between neighbour sensitive volumes for the latest generation of fully optimised 3D MEMS micro dosimeters, configured as arrays of individual cell-sized sensitive volumes based on P-N junctions, developed by the CMRP, University of Wollongong, and produced by the SINTEF.

The synchrotron light microbeam and the external ion microbeam irradiation have been used to determine TID for commercial off the shelf memory and logic IC's in order to test their suitability for space applications. We discuss TID values obtained by ions and X-rays, and compare them with gamma rays, as well as variability between samples.

The high-precision scanning ion microbeam has been used for the study of Single Event Upset (SEU) in a custom-designed radiation-hardened SRAM chip with a novel memory cell architecture developed for applications in harsh radiation conditions including Earth orbits, space, and high-radiation high-energy terrestrial facilities. We present findings and compare radiation damage with observations from using COTS (non-hardened) SRAM chips.

Keywords: space, nuclear microprobe, microdosimeter, SEU, SRAM chip

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Speaker:

Zeljko Pastuovic got his PhD in Physics – Condensed Matter from University of Zagreb, Croatia in 2009 for research on: “Deterioration of Electrical Properties and Charge Collection Efficiency of a Silicon Photodiode Exposed to Focused Ion Beam Irradiation”. In 2014 he became the Research Associate with the Faculty for Natural Sciences and Mathematics of the University of Zagreb.

Today he is a Senior research physicist – accelerator scientist with the Centre for Accelerator Science of ANSTO responsible for research leadership in applied accelerator science to advanced materials and devices fabrication - semiconductors, novel opto-electronic materials and devices.

His major field of expertise and internationally recognized contribution is in the field of applied accelerator science and nuclear techniques for: i) the characterization of semiconductor materials used for fabrication of simple electronic structures based on p-n or metal-semiconductor junctions, ii) modification of electronic materials by ion implantation, and iii) the characterization of defects in semiconductors and effects of ionizing radiation on electronic properties of semiconductor devices.

New fields of research include quantum sensing, future low energy electronics, radiation hard space electronics, and radiation therapy.

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