"1st Workshop on Radiation Hard Semiconductor Devices for Very High Luminosity Colliders"

Simulation and Investigation of Radiation Damage in Silicon Detectors for LHC, VHLC in RRC "Kurchatov Institute"

A.I.Ryazanov

Russian Research Center " Kurchatov Institute"
123182,Moscow ,Russia

CERN, 28-30 November, 2001

Experimental Investigations

(i) irradiation of the semiconductor detectors at room temperature (~20^{0}C) under neutron source for several neutron fluence up to 10^{15} n/cm^2 with average energy of neutrons 17 MeV,

(ii) irradiation of the semiconductor detectors at room temperature (~20^{0}C) by protons with energy 35 MeV and heavy ions with energy 250 MeV for several fluences up to 10^{15} p/cm^2,

(iii) investigation of crystalline structure changes before and after neutron and heavy ion irradiation using transmission electron microscopy (TEM JEOL 100CX) studies,

(iv) measurement of crystalline structure modification of irradiated samples compared to the non-irradiated samples by X-ray structure measurements (triple crystal spectra for different Bragg reflections ((400), (111), (311)) to allow measurement of the accumulation of radiation damage clusters in the materials as a function of fluence,

(v) measurement of the electrical characteristics of the irradiated samples (I(V) -leakage current, breakdown field C(V) - full depletion voltage),

Theoretical research

(vi) calculations of elastic and electronic (non-elastic) energy loss for PKAs under proton and neutron irradiation,

(vii) theoretical and numerical calculations of the radiation defect cluster formation in the semiconductor materials as a function of the neutron spectrum and energy of heavy ion irradiation,

(viii) determination of correlation in the degradation of radiation resistance of semiconductor detectors using obtained data by different methods: TEM,X-ray diffraction, optical method, theoretical calculations and electrical characteristics measurement,