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Compensation for Radiation Damage to SOI Pixel Detector via Tunneling

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We have been developing a method for removing holes trapped in the oxide layer of a silicon-on-insulator (SOI) monolithic pixel detector after irradiation. Radiation that passes through the detector generates positive charge in the buried oxide layer (BOX) underneath the MOSFET. The positive potential caused by these trapped holes modify the characteristics of the MOSFET of the signal readout circuit, especially a negative shift in the threshold voltage V_{th} . In order to compensate for the effect of the positive potential, we tried to recombine the trapped holes with electrons via Fowler-Nordheim (FN) tunneling. By applying high voltage pulse (~ 0.6 GV/m for 3 s) to a electrode under the BOX with the MOSFET fixed at 0 V, electrons were injected into the BOX by FN tunneling. We irradiated test element groups of MOSFETs with ^{60}Co γ -ray up to 2 MGy. These MOSFETs are processed on a double SOI wafer. The double SOI wafer has middle Si layer in the BOX, and this middle Si is used as the electrode for applying high voltage pulse. In this presentation, recent results on the above samples will be reported.

Primary author: YAMADA, Miho (KEK)

Co-authors: ARAI, Yasuo (High Energy Accelerator Research Organization (JP)); KURACHI, Ikuo (High Energy Accelerator Research Organization)

Presenter: YAMADA, Miho (KEK)

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