



Contribution ID: 10

Type: **not specified**

Leakage Current Measurements of highly irradiated Silicon Strip Sensors

Wednesday 8 October 2014 16:40 (20 minutes)

The leakage current of irradiated silicon sensors depends, among others, on sensor temperature and irradiation fluence. The temperature dependence is parameterized with the activation energy E_g and the fluence dependence with the current related damage rate α . The literature values for E_g and α are obtained from previous measurements, but α is only measured directly to a dose up to $1e15$ 1MeV neq/cm^2 (neq/cm^2).

Miniature micro-strip sensors ($\sim 1 \times 1\text{cm}^2$) were irradiated with protons to fluences from $1e12$ to $1e15$ neq/cm^2 and with neutrons from $5e15$ to $2e16$ neq/cm^2 to investigate the reverse current at higher fluence. Precise temperature and current measurements of the sensors from Hamamatsu Photonics K.K. ($300\mu\text{m}$ thick) and Micron Semiconductor Ltd. ($143\mu\text{m}$ and $108\mu\text{m}$ thick) allow the determination of E_g and α . The sensors were measured shortly after irradiation and after room temperature annealing. For the devices irradiated to higher fluences the obtained values differ from the literature value of E_g and the expected value from the linear extrapolation of α .

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Session Classification: Irradiated Silicon Detectors