

Effect of Al₂O₃ passivation layer in irradiated n-on-p strip sensors [Thursday]

Thursday 3 December 2015 17:40 (20 minutes)

The significant advantages of detectors manufactured on p-type silicon material over n-type detectors in the HEP particle tracking applications have been well documented in the R&D community. In AC-coupled p-type position-sensitive strip detectors, however, the fixed oxide charge in the silicon dioxide is positive and, thus, causes electron accumulation at the Si/SiO₂ interface. Thus, the n-type strips become short-circuited without additional isolation implantations. The higher processing complexity resulting from this requirement can be avoided by the use of aluminum oxide (Al₂O₃, alumina) thin-film insulator, grown by Atomic Layer Deposition (ALD) method. The negative oxide charge in ALD-oxide provides strip isolation without any additional isolation structures. Measurement and TCAD simulation study of a MOS test structure with alumina layer show a considerable accumulation of negative oxide charge in ALD-oxide after Co-60 gamma-ray irradiations. Also a comparative study of the simulated surface properties between alumina, p-stop and p-spray sensors will be presented. Furthermore, measurements of 2e15 neq/cm² proton irradiated p-type MCz-Si strip sensors with alumina thin-film insulator are compared to the simulations of corresponding sensor design as well as with conventional isolation structures.

Summary

The effect of Al₂O₃ passivation layer in n-on-p strip detectors irradiated by protons up to 2e15 neq/cm² was studied both by measurements and TCAD simulations. The accumulation of negative oxide charge in ALD-oxide was verified by Co-60 gamma-ray irradiations.

Authors: HAERKOENEN, Jasu (Helsinki Institute of Physics (FI)); PELTOLA, Timo Hannu Tapani (Helsinki Institute of Physics (FI))

Presenter: PELTOLA, Timo Hannu Tapani (Helsinki Institute of Physics (FI))

Session Classification: Simulations