

11th International "Hiroshima" Symposium on the Development and Application of Semiconductor Tracking Detectors (HSTD11) in conjunction with 2nd Workshop on SOI Pixel Detectors (SOIPIX2017) at OIST, Okinawa, Japan

Contribution ID: 95

Type: POSTER

Study of n-on-p sensors breakdown in presence of dielectrics placed on top surface

Sunday 10 December 2017 20:25 (1 minute)

The ATLAS Experiment at LHC will have several upgrade projects for High Luminosity LHC operations. Its tracking system will be replaced to cope with the higher interaction rate and radiation levels. The Strip portion of the tracker will be significantly expanded in radius and instrumented area to control the occupancy and momentum resolution. The strip modules are based on large-area n-on-p sensors with short strips, designed to work with the larger particle fluxes and radiation hardness requirements.

The strip module design has readout flex circuit glued directly on top of the sensors' active area to facilitate the assembly process and minimize the radiation length. Adhesive spread outward to the guard ring (GR) region is typically avoided to control the sensor breakdown. However, due to the large number of modules to be constructed, on the order of 20000, such occasions may in principle happen, depending on the process precision control. Therefore, the adhesive influence on the sensor breakdown and the breakdown mechanism are of interest.

In this contribution we report on the studies of the breakdown behavior with prototype sensors, where adhesives were placed on top of the sensor, either directly in the GR region, or in the active area far away from it. Several adhesives under consideration for module building were used in these measurements. In additional tests, non-shrinking dielectrics were placed on top of the sensors in order to check the influence of mechanical stress created by glue shrinkage during curing. The measurements after thermo-cycling were also performed.

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Session Classification: POSTER

Track Classification: Strip sensors