

# Processing of pixel detectors on p-type MCz silicon using atomic layer deposition (ALD) grown aluminium oxide

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We report on the fabrication of DC- and AC-coupled n<sup>+</sup>-in-p pixel detectors on magnetic Czochralski silicon substrates, using aluminium oxide (Al<sub>2</sub>O<sub>3</sub>) thin films grown by atomic layer deposition (ALD) as dielectric and field insulator. Al<sub>2</sub>O<sub>3</sub> thin films exhibit high negative oxide charge, and thus do not require p-stop/p-spray insulation implants between pixels. In addition, they provide higher capacitance densities than SiO<sub>2</sub>, permitting more efficient capacitive coupling of pixels.

For bias resistors, sputtered titanium nitride (TiN) is used.

The mask layout includes AC-coupled detectors compatible with the CMS PSI46dig readout chip, DC-coupled detectors with 50x50 μm pixels in a geometry to match the new RD53A readout chip, as well reference structures, such as diodes and MOS capacitors.

Results of characterization of diodes and MOS capacitors with CV, IV, and TCT measurements are presented, and the effect of gamma irradiation on these devices is discussed. Results show the expected high negative charge of the Al<sub>2</sub>O<sub>3</sub> dielectric and acceptable leakage currents. In both new and older devices, we observe the compensation of acceptors in the p-type Si bulk upon gamma irradiation, to the point of apparent type-inversion in some cases. Pixel detectors await flip-chip bonding and characterization with the appropriate readout chips.

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