Contribution ID: **115** Type: **Oral**

Manufacturing of pixel detectors for radiation imaging by chromium compensation of gallium arsenide wafers

Tuesday 28 June 2022 16:50 (20 minutes)

Gallium arsenide has noticeable advantages over silicon for radiation detector manufacturing. There is particularly a higher electron mobility (8000 vs 1400 cm2/(V·s)), bigger average atomic number (31.5 vs 14) and wider bandgap (1.43 vs 1.12 eV). These advantages result in a better charge collection, higher radiation absorption efficiency, superior radiation hardness and lower noise.

In frame of EU H2020 X-MINE project Advacam has studied the possibilities to produce radiation detectors by chromium compensation of commercially available 3”n-type GaAs wafers. Wafers were annealed in a quartz reactor; processed by polishing and CMP; and then patterned, metallised, and diced. We have demonstrated a wafer-level processing using sensor designs compatible with Timepix/Medipix family readout ASICs.

It was concluded that radiation sensors of chromium compensated GaAs demonstrate X-ray imaging quality that is comparable to the level of commercially available CdTe semiconductor sensors.

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Session Classification: Sensors