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Active Edge Silicon Sensors Fabricated with Side Implants

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Silicon detectors with reduced inactive regions around their periphery are desirable for applications in high-energy physics, X-ray experiments, and medical imaging. Typically, an insensitive area is required to accommodate guard rings, which help maintain the electric field distribution around peripheral pixels and isolate defects at the physical edges of the detectors that could otherwise generate high leakage currents.

A solution to reduce or eliminate this dead area is the use of active-edge or 3D technology [1,2]. However, implementing active edges presents significant challenges in sensor fabrication and is ideally performed after all other processing steps. This is generally not feasible with conventional methods due to the high-temperature annealing required after doping the guard rings or active-edge structures [3,4]. Additionally, sensors with thicknesses of 500 μm or even 1 mm are desirable for broader spectrum X-ray energy detection, but etching through substrates thicker than 300 μm is extremely difficult and costly.

Microwave annealing offers a promising alternative to traditional high-temperature annealing, as it can be applied after fabrication is complete. In this process, dopants are activated while the bulk temperature remains below 500 $^{\circ}\text{C}$ [5–7]. This study explores a new method of achieving active-edge detectors, in which the device edges are implanted after all other processing steps and subsequently annealed at low temperature using microwave annealing. This approach enables the fabrication of active edges in thicker substrates while also reducing overall manufacturing costs. Preliminary results of current versus bias voltage measurements on both n-in-p and p-in-n devices, before and after implantation and annealing, will be discussed.

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Type of presentation (in-person/online)

online presentation (zoom)

Type of presentation (I. scientific results or II. project proposal)

I. Presentation on scientific results

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