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Micro-patterned Ga2O3 Thin Films for Synchrotron X-ray Photodetectors

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Ga2O3, with its wide bandgap (4.9 eV) and high breakdown field (8 MV/cm), has been widely studied for high-power electronics and solar-blind photodetectors, and more recently explored for X-ray detection, though mostly with in-house sources.
Here we demonstrate a micro-patterned device fabricated by H3PO4 wet etching at 120 ℃ on Ga2O3/sapphire (0001) thin films synthesized by RF powder sputtering, and evaluate its X-ray sensing under a 10 keV synchrotron micro-beam focused to ~ 10 × 30 μm2. Four-point probe measurements were performed while toggling irradiation at bias voltages from self-powered (0 –0.1 V) up to 20 V. Compared with unpatterned devices, the micro-patterned Ga2O3 exhibits an order-of magnitude higher current gain, reaching photocurrents of ~ 1 μA, a practical detection level. The photocurrent-to-darkcurrent ratio (PDCR) improves more modestly, due to trap sites introduced at etched sidewalls, which increase the darkcurrent.
Sensing responses were fitted with a simple two-component model, yielding rise and decay times comparable to unpatterned films. This indicates that micro-patterning mainly enhances collection efficiency without altering intrinsic recombination. These findings demonstrate a simple and scalable strategy to improve Ga2O3 X-ray photodetectors without complex device architectures. Detailed results on X-ray photo-current measurements will be presented.

Paper submission Plan

Yes

Best Presentation

No

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