

Supporting Information

Band Gap Engineering in β -Ga₂O₃ for High-Performance X-ray Detector

Zhiwei Li,[⊥] Jiawen Chen,[⊥] Huili Tang,[⊥] Zhichao Zhu,[⊥] Mu Gu,[⊥] Jun Xu,[⊥] Liang Chen,[#]

Xiaoping Ouyang,[#] and Bo Liu^{*,⊥}

[⊥]Shanghai Key Laboratory of Special Artificial Microstructure Materials and Technology, School of Physics Science and Engineering, Tongji University, Shanghai 200092, P. R. China

[#]Northwest Institute of Nuclear Technology, Xi'an 710024, P. R. China

*E-mail: lbo@tongji.edu.cn

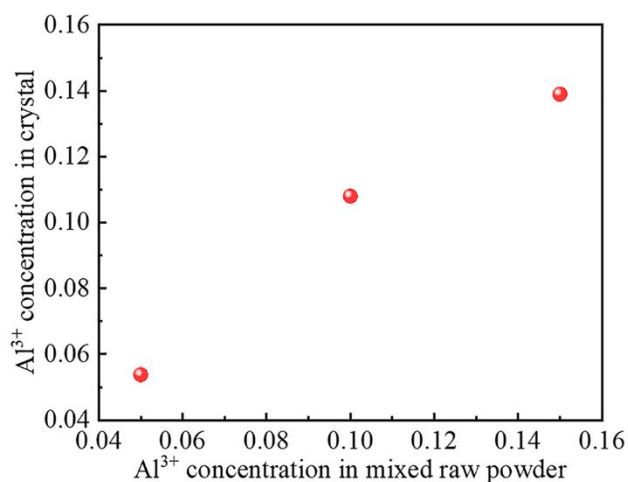


Figure S1. Al³⁺ concentration in crystal vs Al³⁺ concentration in mixed raw power.

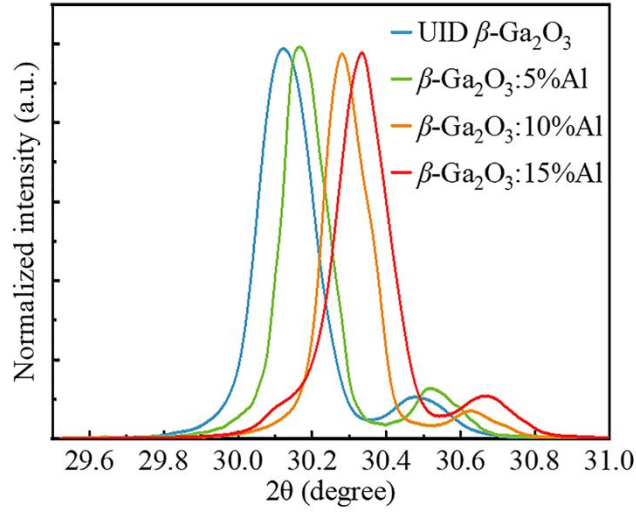


Figure S2. XRD patterns of (400) peak of UID β -Ga₂O₃, β -Ga₂O₃:5%Al, β -Ga₂O₃:10%Al and β -Ga₂O₃:15%Al single crystals.

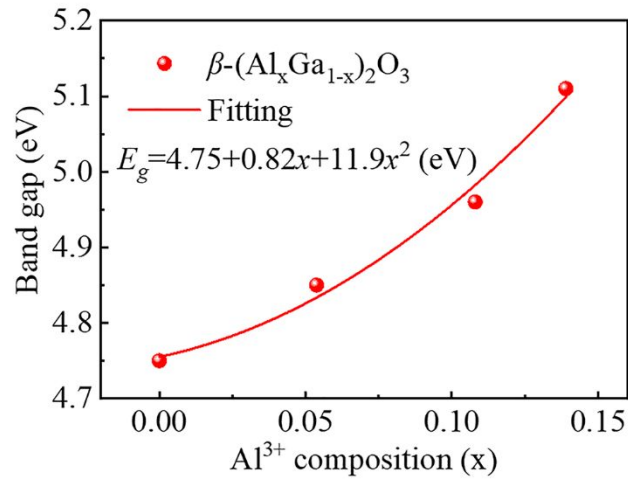


Figure S3. Dependence of band gap of β -Ga₂O₃:Al on Al³⁺ composition.

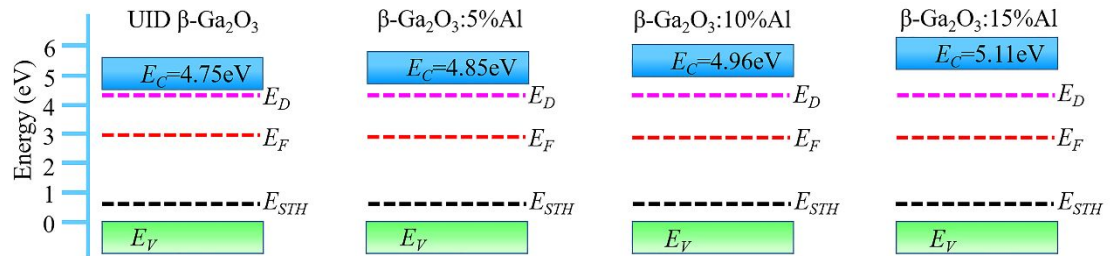


Figure S4. Energy band diagram of the UID β -Ga₂O₃ and β -Ga₂O₃:Al crystals.

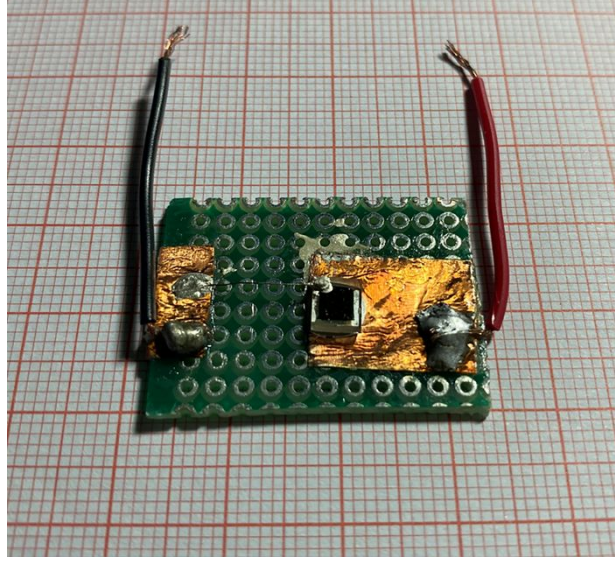


Figure S5. Photograph of the β -Ga₂O₃:15%Al-based X-ray detector.

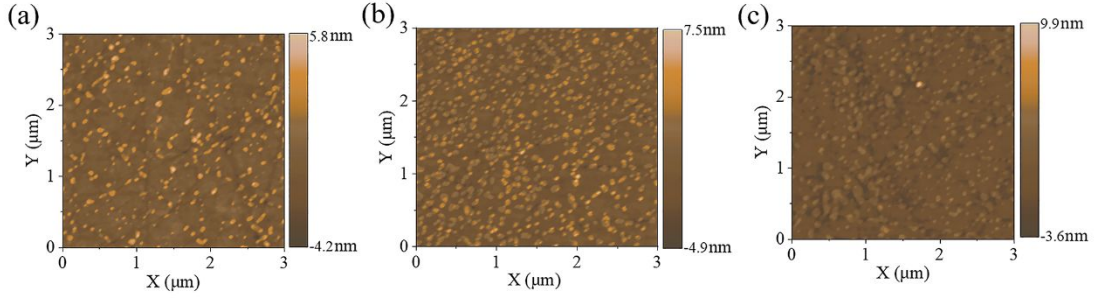


Figure S6. AFM images of the polished (a) β -Ga₂O₃:5%Al, (b) β -Ga₂O₃:10%Al and (c) β -Ga₂O₃:15%Al single crystals. The root-mean-square roughness of β -Ga₂O₃:5%Al, β -Ga₂O₃:10%Al, and β -Ga₂O₃:15%Al crystals are 1.21, 1.67 and 1.45 nm, respectively.

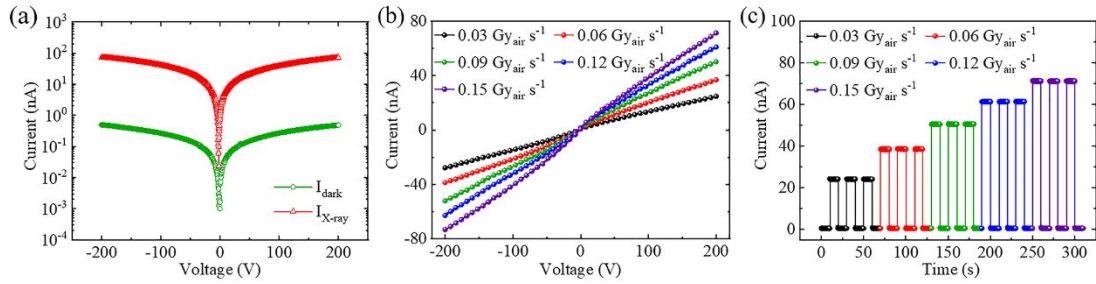


Figure S7. Performance of the β -Ga₂O₃:10%Al-based X-ray detector. (a) I - V curves on a logarithmic scale of the detector in the dark and under X-ray irradiation. (b) I - V curves of the detector under X-ray irradiation with different dose rates. (c) Current response characteristics of the detector at 200 V when exposed to the different dose rates.

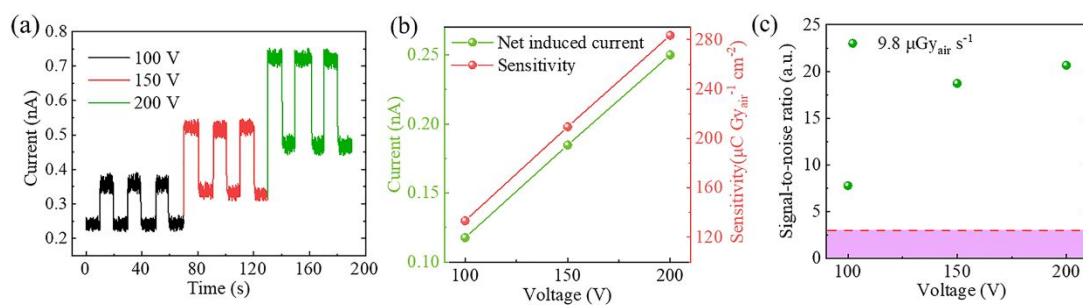


Figure S8. Performance of the $\beta\text{-Ga}_2\text{O}_3\text{:10\%Al}$ -based X-ray detector under an X-ray dose rate of $9.8 \mu\text{Gy}_{\text{air}} \text{ s}^{-1}$. (a) Current response of the detector at different applied voltages. (b) Net induced current and sensitivity characteristics at different applied voltages. (c) SNR of the detector, where the red dashed line represents an SNR of 3.