One-Dimensional Wide-Bandgap Semiconductor β-Ga_2O_3 Nanorods for High-Performance Solar-Blind Ultraviolet Photodetectors

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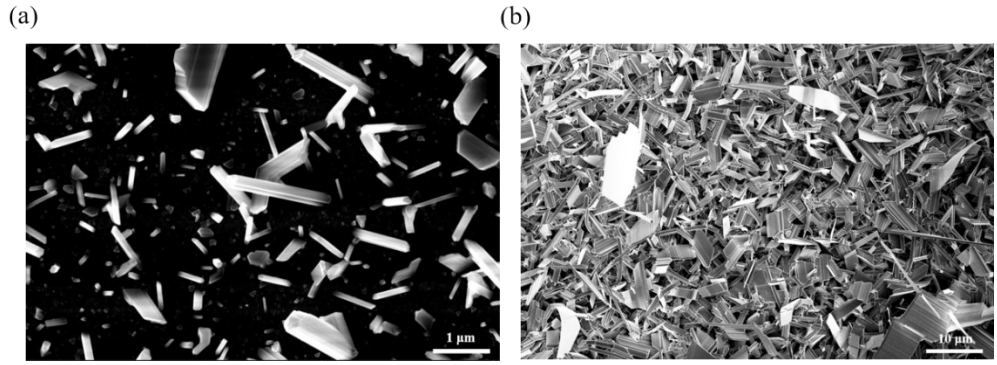

Fig. S1 SEM images of β-Ga_2O_3 products obtained under non-optimized LPCVD growth conditions: (a) larger source–substrate distance, (b) higher oxygen partial pressure.

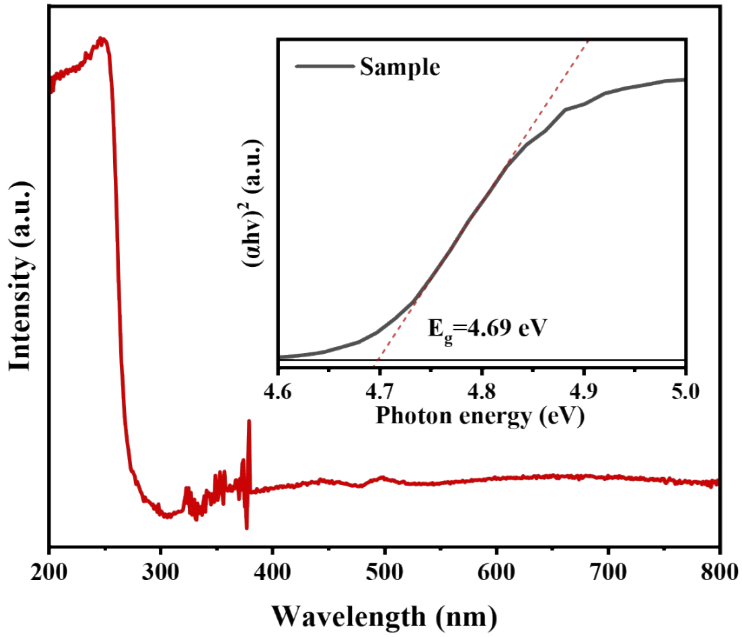

Fig. S2 UV–Vis absorption spectrum of a companion β-Ga_2O_3 sample grown on a transparent sapphire substrate. The inset shows the corresponding Tauc plot, from which the optical bandgap is estimated to be approximately 4.69 eV.

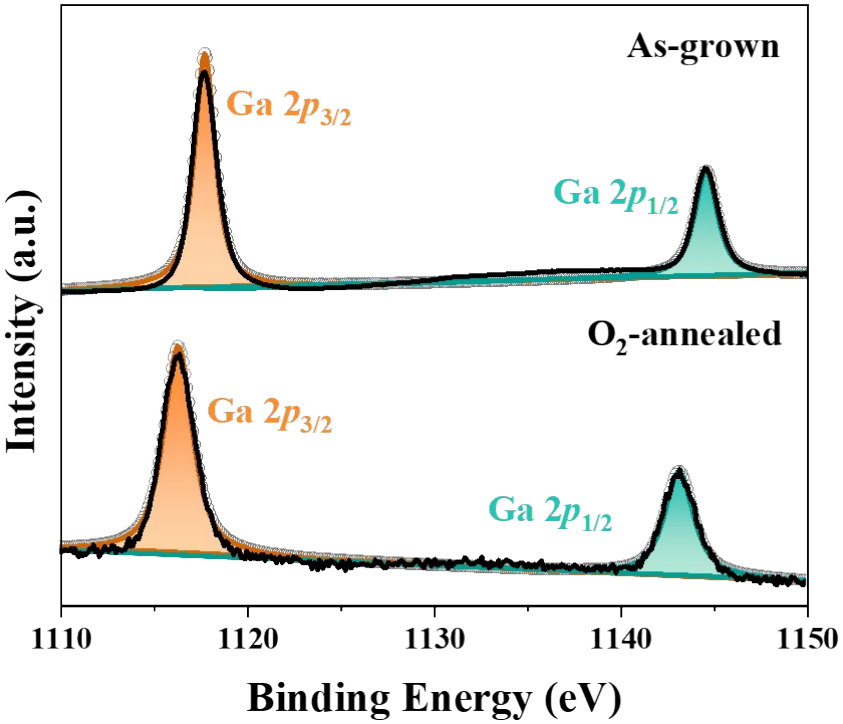

Fig. S3 Ga 2p spectra of β-Ga_2O_3 nanorods before and after annealing in an oxygen atmosphere.

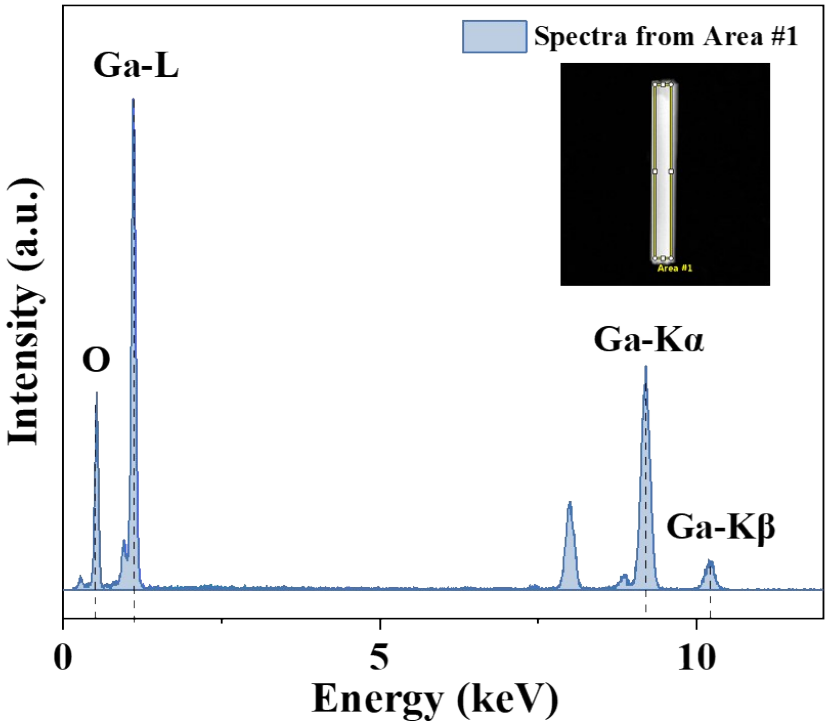

Fig. S4 STEM-EDS of a single β-Ga_2O_3 nanorod.

Fig. S5 Additional SEM images taken from different regions of the optimized β-Ga_2O_3 nanorod film grown on a 1 × 1 cm^2 SiO_2/Si substrate.

PEAK	BE (eV)	FWHM(eV)	Area
O-Ga(As-grown)	530.7	1.34	506306.2
V_O(As-grown)	532.2	1.96	156949.9
O-Ga(O_2-annealed)	530.7	1.48	751789.4
V_O(O_2-annealed)	532.2	1.80	67661.05

Table S1 XPS spectral deconvolution of O 1s.

Method	Morphology	Wavelength	PDCR	Rise/Decay Time
Hydrothermal	Nanorod array	254nm	9.14	0.64 / 0.38 s[1]
CVD	Single microwire	254nm	2.5×10^3	0.37 / 0.25 s[2]
Mist-CVD	Thin film	254nm	100	NR[3]
MOCVD	Thin film	254nm	2.3×10^3	0.38 / 0.11s[4]
This	Nanorod film	254nm	6×10^3	0.30 / 1.61 s

Table S2. Comparison of representative MSM β-Ga_2O_3 photodetectors prepared by different methods.

Reference：

[1] Wang S, Chen K, Zhao H, et al. β-Ga_2O_3 nanorod arrays with high light-to-electron conversion for solar-blind deep ultraviolet photodetection. RSC Adv., 2019, 9, 6064–6069.

[2] Feng Q, Dong Z, Liu W, et al. High responsivity solar-blind UV photodetector based on single centimeter-sized Sn-doped β-Ga_2O_3 microwire. Micro and Nanostructures, 2022, 167, 207255.

[3] Xu Y, An Z, Zhang L, et al. Solar blind deep ultraviolet β-Ga_2O_3 photodetectors grown on sapphire by the Mist-CVD method. Opt. Mater. Express, 2018, 8, 2941–2947.

[4] Ma Y, Tang W, Chen T, et al. Effect of off-axis substrate angles on β-Ga_2O_3 thin films and solar-blind ultraviolet photodetectors grown on sapphire by MOCVD. Mater Sci Semicond Process, 2021, 131: 105856.