Supplementary information

Self-powered photodetector with low dark current based on the InSe/β-Ga_2O_3 heterojunctions

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The growth quality of films is affected by different types of precursor solutions. Ethylene glycol and ethylene glycol methyl ether are used as solvents for precursor solutions. The morphology of film growth was characterised using scanning electron microscopy (SEM) and atomic force microscopy (AFM), as demonstrated in Figure S1(a), the use of ethylene glycol methyl ether resulted in agglomeration of the gallium oxide material on the surface, leading to a high root-mean-square roughness of 23. However, when ethylene glycol was used as the solvent, the film surface was flat with a much lower RMS roughness of 1.18 nm, as depicted in Figure S1(b) and (c). Therefore, ethylene glycol will be used as the solvent for further experiments.

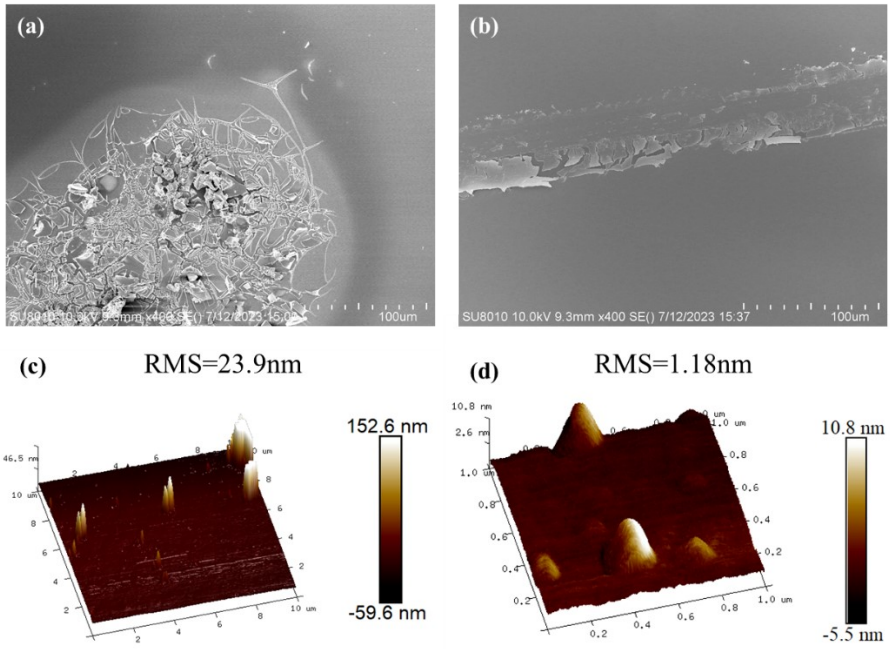

Figure S1 The SEM scanning morphology of β-Ga_2O_3 prepared using two different solvents: (a) ethylene glycol methyl ether and (b) ethylene glycol. AFM images of β-Ga_2O_3 prepared with the same solvents are presented in (a) and (b).

The study investigated the effect of spin-coating up to 5 and 10 layers with 0.8 mol/L precursor solution (using ethylene glycol as a solvent) on the flatness of the film(Figure S2). The results showed that the film quality of gallium oxide films did not change with the increase in spin-coating thickness.

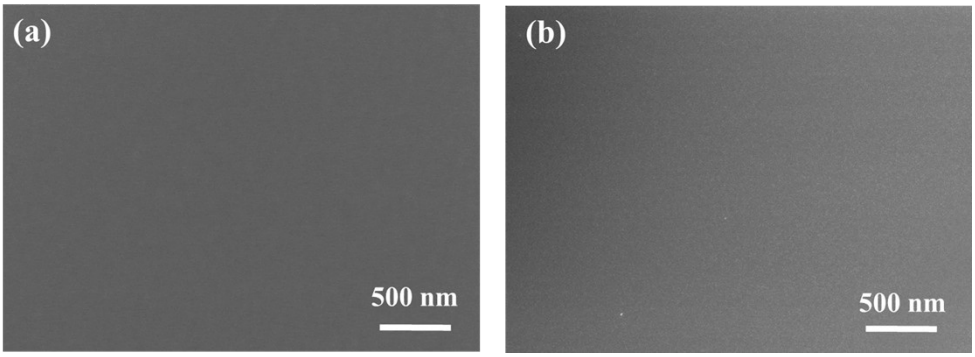

Figure S2 The SEM morphology of β-Ga_2O_3 prepared by spin-coating solutions of different thicknesses. (a) The morphology after 5 layers were spin-coated, (b) the morphology after 10 layers were spin-coated.

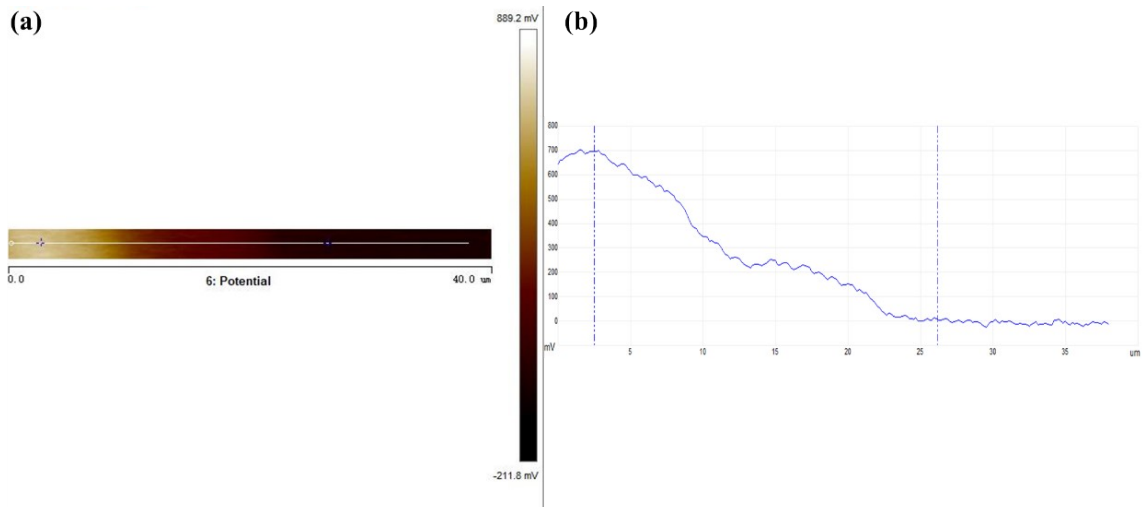

Figure S3 KPFM characterisation of Au standard sample.