The Effect of a Nucleation Layer on Morphology and Grain Size in MOCVD- Grown β-Ga_2O_3 Thin Films on C-Plane Sapphire

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β-Ga_2O_3 thin films grown on widely available c-plane sapphire substrates typically exhibit structural defects due to significant lattice and thermal expansion mismatch, which hinder the use of such films in electronic devices. In this work [1], we studied the impact of a nucleation layer on MOCVD-grown β-Ga_2O_3 thin film structure and morphology on a c-plane sapphire substrate. The structure and morphology of the films were investigated by X-ray diffraction, atomic force microscopy, transmission and scanning electron microscopy, while the composition was confirmed by X-ray photoelectron spectroscopy and micro-Raman spectroscopy. It was observed that the use of a nucleation layer significantly increases the grain size in the films in comparison to the films without (Sample A), particularly in the samples in which H_2O was used alongside O_2 as the oxygen source (Sample C) for the nucleation layer growth (in contrast to Sample B with only O_2). Our study demonstrates that a nucleation layer can play a critical role in obtaining high quality β-Ga_2O_3 thin films on c-plane sapphire.
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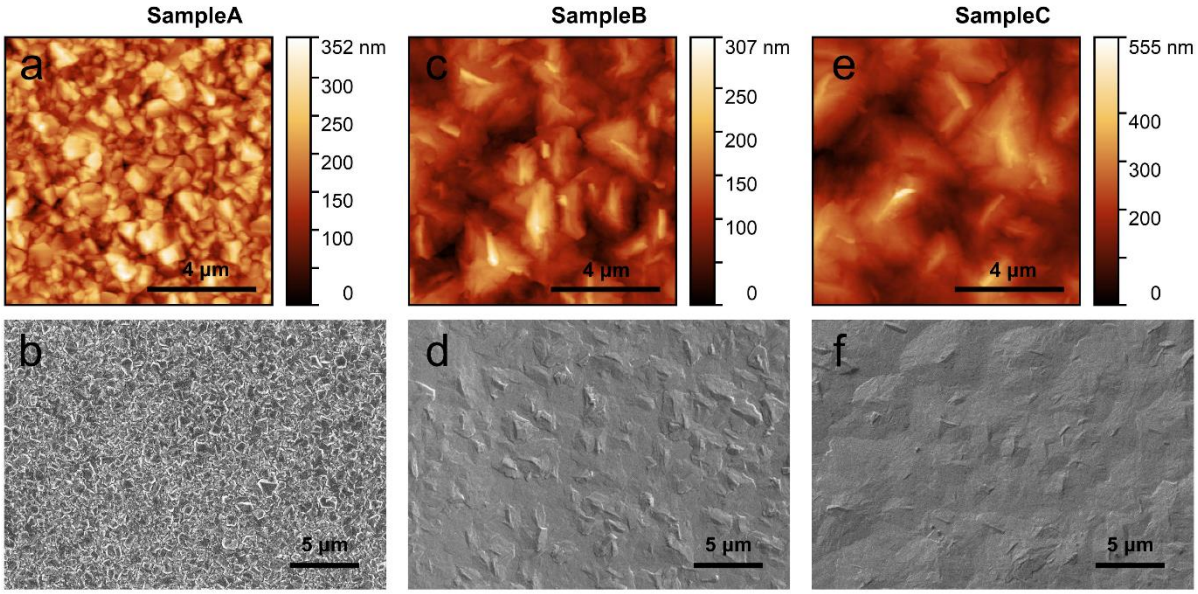

Fig. 1. Atomic force microscopy (10 × 10 µm scans) and scanning electron microscopy images of (a,b) Sample A, (c,d) Sample B and (e,f) Sample C, respectively, showing the surface morphology of the as-grown Ga_2O_3 films.

References

[1] Dimitrocenko, L., Strikis, G., Polyakov, B., Bikse, L., Oras, S., Butanovs, E. The Effect of a Nucleation Layer on Morphology and Grain Size in MOCVD-Grown β-Ga2O3 Thin Films on C-Plane Sapphire. *Materials*. 15, 8362 (2022).