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Composition and band gap of aluminum alloyed beta-gallium oxide determined by XPS — •Lukas Schewe[1], Jana Rehm[2], Ming-Chao Kao[3], Vedran Vonk[3], Zbigniew Galazka[2], Saud Bin Anooz[2], Andreas Popp[2], and Jan Ingo Flege[1] — [1]Fachgebiet Angewandte Physik und Halbleiterspektroskopie, BTU Cottbus-Senftenberg — [2]Leibnitz-Institut für Kristallzüchtung, Berlin — [3]CXNS-Center for X-ray and Nano Science, DESY Hamburg

Beta-phase gallium oxide is a wide-gap semiconductor with a band gap of 4.85eV and promising prospects in high-power electronics. The electric breakdown field can be increased by alloying the oxide with aluminum, further enhancing its properties.
The present work discusses structural and electronic properties of β-$(Al_xGa_{1-x})_2O_3$ thin films and bulk crystals with Al content of up to 33 %. Their Al content was determined by X-ray photo-electron spectroscopy (XPS) and compared to the values estimated from X-ray diffraction (XRD) and inductively coupled plasma optical emission spectroscopy (ICP-OES). Additionally, the thin films have been investigated by XPS depth profiling, i.e., XPS combined by sequential Ar^+ sputtering, revealing lower aluminum content at the sample surface, which points to possible surface segregation of gallium during annealing. Furthermore, the band gap was determined by electron loss spectra from XPS and optical absorbance measurements and correlated to the Al content estimated for both thin films and bulk crystals.

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