

Supporting Information

Band offsets at κ -([Al,In]_xGa_{1-x})₂O₃/MgO interfaces

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Table S1: Summary of all measured core level and valence band onset (VBO) binding energies for all In and Al concentrations as well as bulk MgO.

In/(In+Ga) ratio (%)	Ga2p _{3/2} BE (eV)	Mg1s BE (eV)	VBO (eV)	ΔE_V (eV)
bulk MgO		1304.86	2.84	
0	1118.32		2.39	
0 + MgO cap	1118.20	1304.36		+0.03
11	1118.31		2.23	
10 + MgO cap	1118.19	1304.75		-0.62
17	1118.27		2.27	
16 + MgO cap	1118.53	1304.81		-0.26
27	1118.36		2.12	
26 + MgO cap	1118.41	1304.60		-0.41

Al/(Al+Ga) ratio (%)	Ga2p _{3/2} BE (eV)	Mg1s BE (eV)	VBO (eV)	ΔE_V (eV)
7	1118.37		2.38	
7 + MgO cap	1118.16	1304.4		-0.21
28	1118.44		2.52	
28 + MgO cap	1118.37	1304.58		-0.10
36	1118.36		2.23	
36 + MgO cap	1118.40	1304.64		-0.36
55	1118.46		2.48	
55 + MgO cap	1118.31	1304.45		-0.10

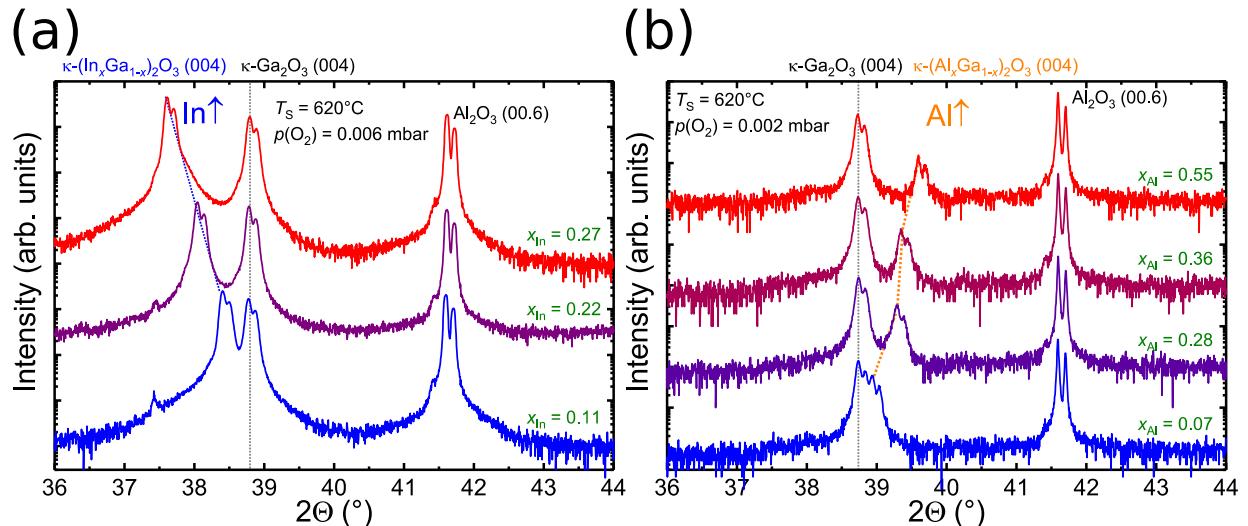


Figure S1: Typical XRD 2θ-ω scans of the investigated samples containing (a) κ -(In_xGa_{1-x})₂O₃ layers and (b) κ -(Al_xGa_{1-x})₂O₃ layers, respectively. In-content x_{In} and Al-content x_{Al} as indicated and determined by XPS measurements. Indexed reflections correspond to purely (001) oriented growth in the orthorhombic modification.

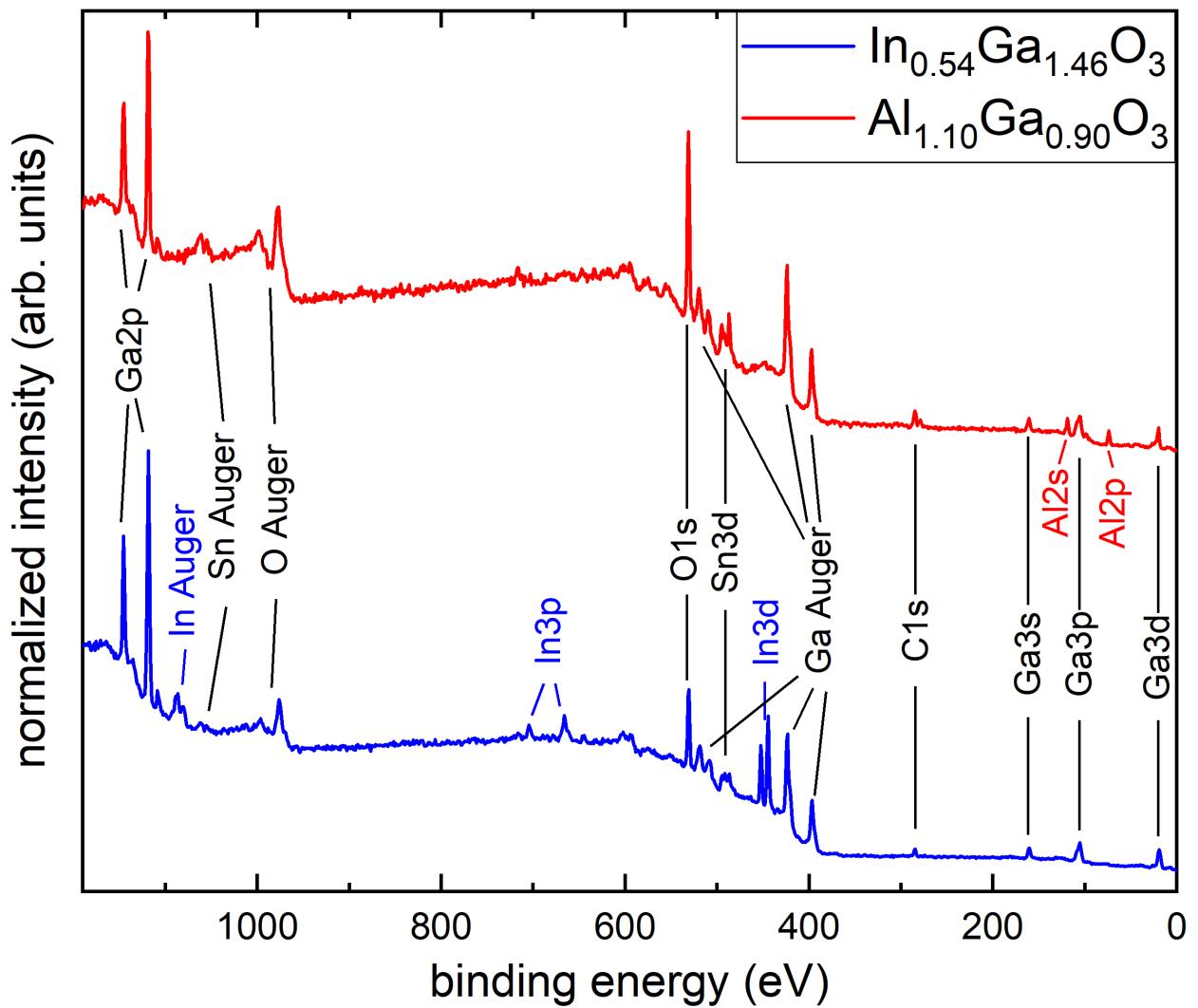


Figure S2: Survey spectra of $\text{In}_{0.54}\text{Ga}_{1.46}\text{O}_3$ (blue, lower curve) and $\text{Al}_{1.10}\text{Ga}_{0.90}\text{O}_3$ (red, upper curve). Black labels correspond to peaks present in both samples, blue labels to indium related peaks and red labels to aluminum related peaks.

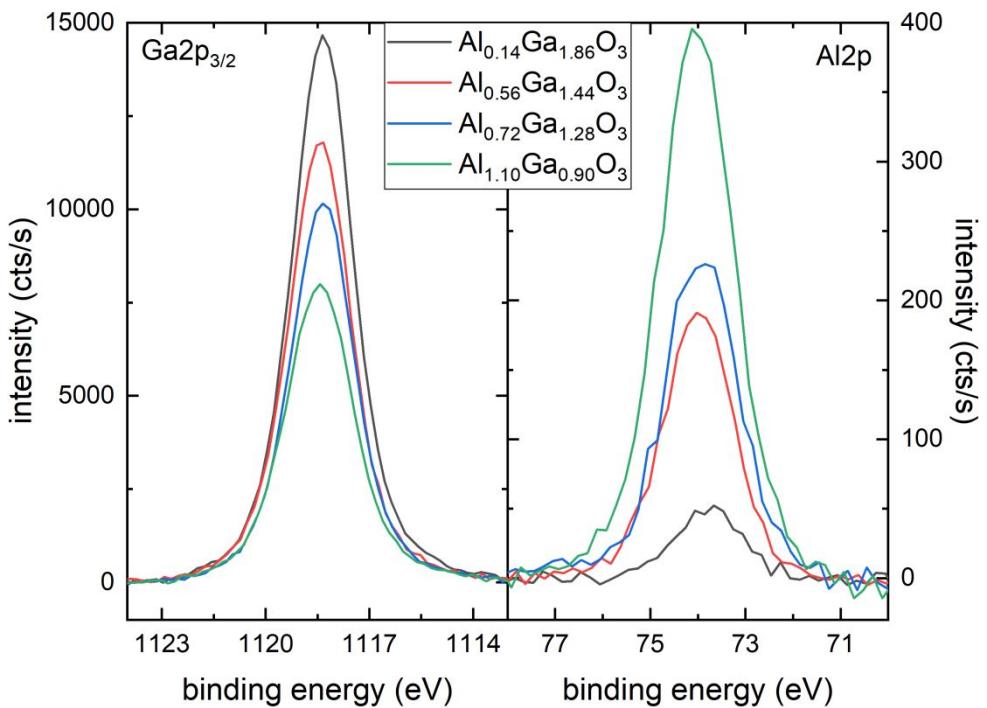


Figure S3: Ga2p_{3/2} and Al_{2p} core level spectra after Shirley-background subtraction, used to determine the different Al-concentrations.

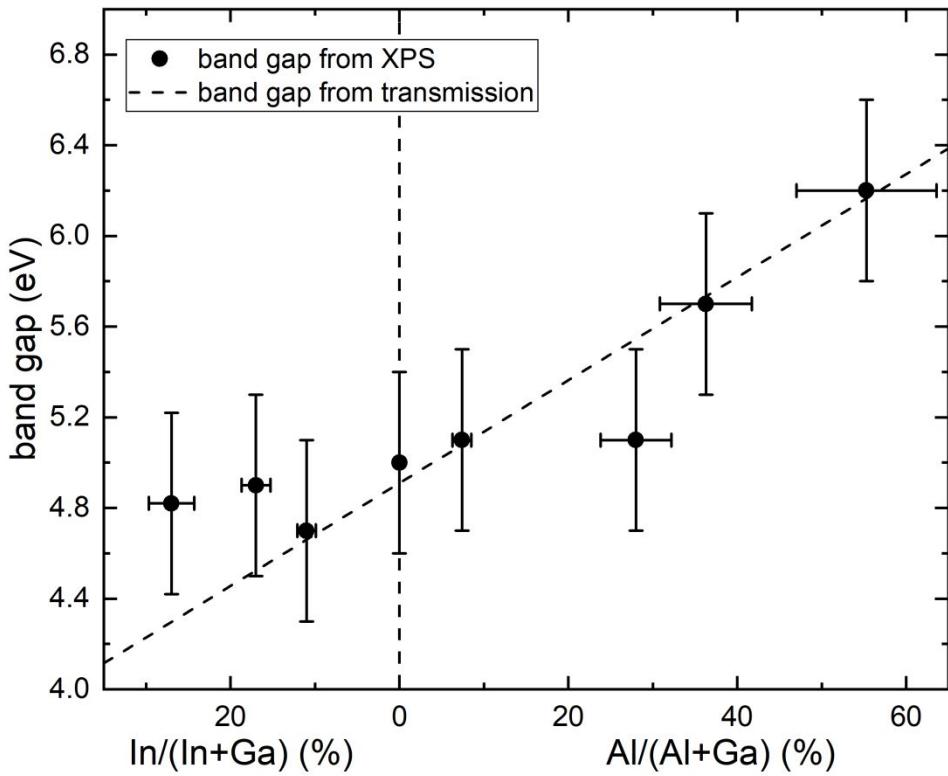


Figure S4: Summary of band gap determination from XPS and comparison to previous results from transmission measurements^{23,24} (dashed line).

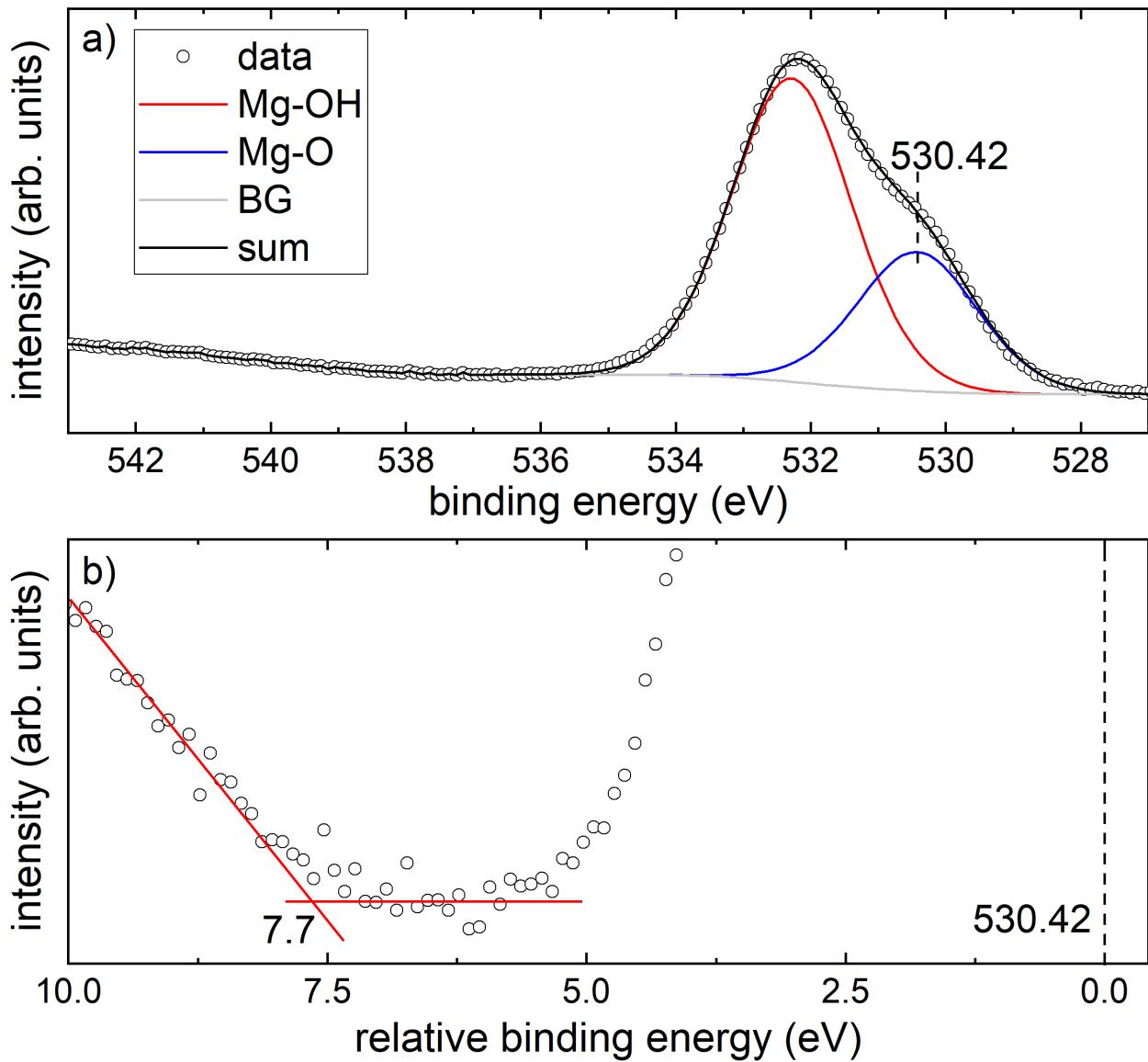


Figure S5: a) O 1s core level of MgO. It consists of two components, once Mg bound to surface -OH groups (red, higher binding energy) and once Mg bound to lattice oxygen (blue, lower binding energy). b) Zoom into the inelastic background region from a). The binding energy is referenced to the Mg-O peak at 530.42 eV binding energy. Extrapolation of the onset of the inelastic background yields a band gap of MgO of 7.7 eV.