Supplementary material (ESI) for Journal of Materials Chemistry C
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Molecular precursor derived and solution processed indium zinc oxide as semiconductor in a field-effect transistor device. Towards an improved understanding of semiconductor film composition.

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Supplementary information

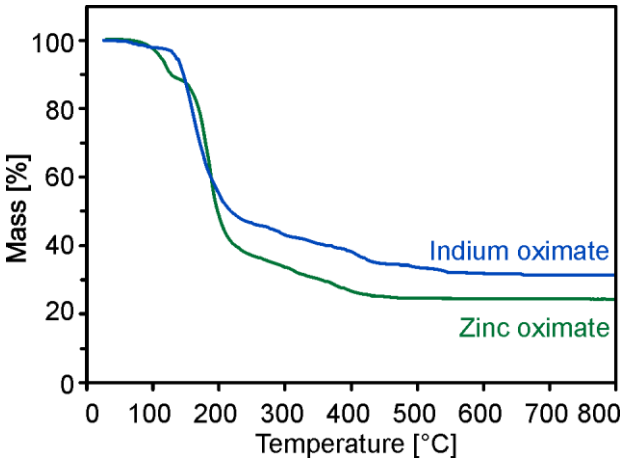

Figure 1: Thermogravimetric mass loss in oxygen atmosphere of the molecular indium and zinc oximato precursors.

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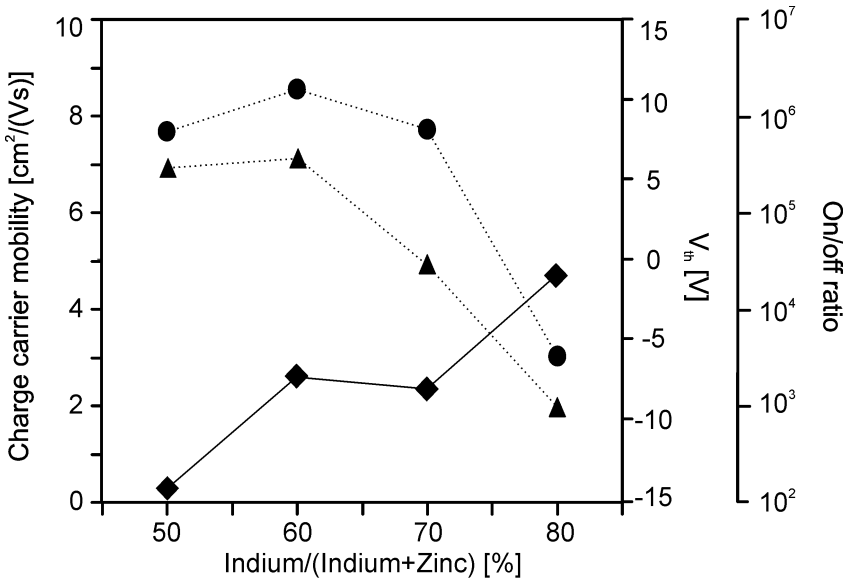

Figure 2: Dependence of electronic performance on indium-zinc ratio: charge carrier mobility μ (squares), $I_{on/off}$ ratio (circles) and threshold voltage V_{th} (triangles). (The lines are a guide to the eye and have no physical meaning.)

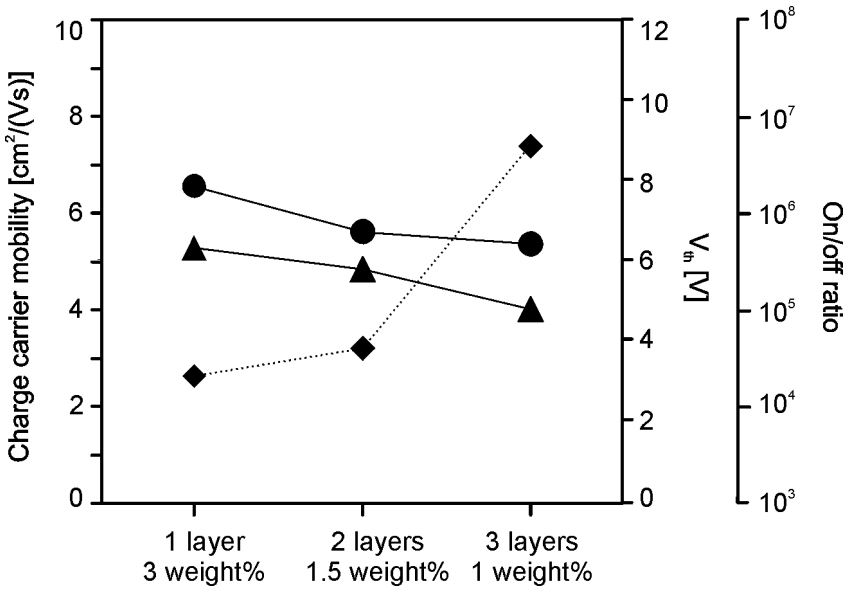

Figure 3: Dependence of electronic performance on precursor concentration/number of deposited layers: charge carrier mobility μ (squares), $I_{on/off}$ ratio (circles) and threshold voltage V_{th} (triangles). (The lines are a guide to the eye and have no physical meaning.)

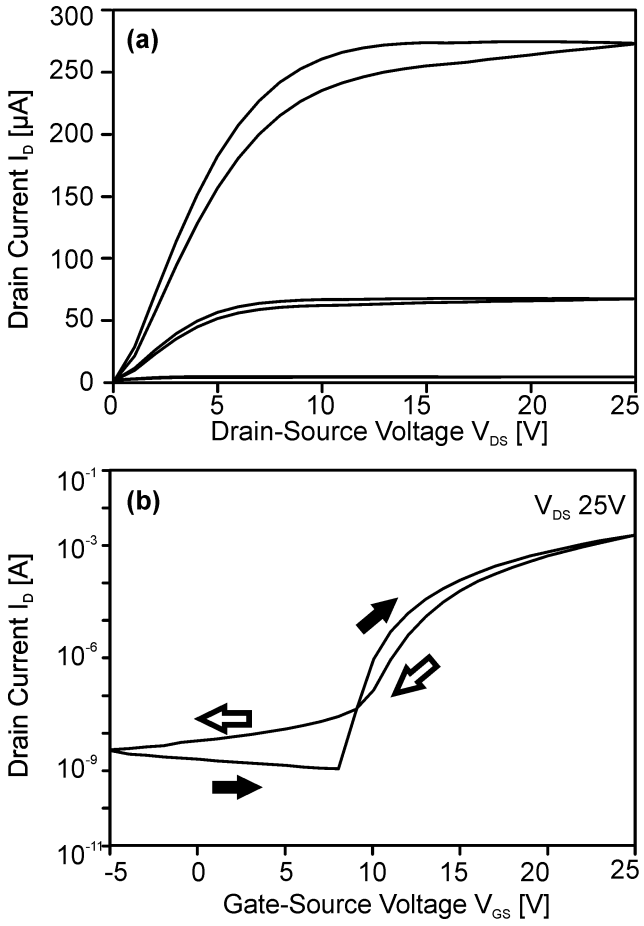

Figure 4: Performance of a FET fabricated from IZO derived by rapid thermal processing of a 60/40 mixture of Indium and zinc oximato complexes at 450°C in air. (a) Output characteristics obtained from variation of the drain-source voltage from 0 - 25 V for gate-source voltages from 0 - 25 V in 5 V steps. Data were acquired for increasing as well as decreasing drain-source voltage. (b) Transfer characteristics for constant drain-source voltage of 25 V. Arrows indicate developing of the curve with increasing and decreasing gate-source voltage. Performance parameters were thereof extracted as µ 0.28 $cm^2/(Vs)$; V_{th} +11.0 V and $I_{on/off}$ ~845.000.

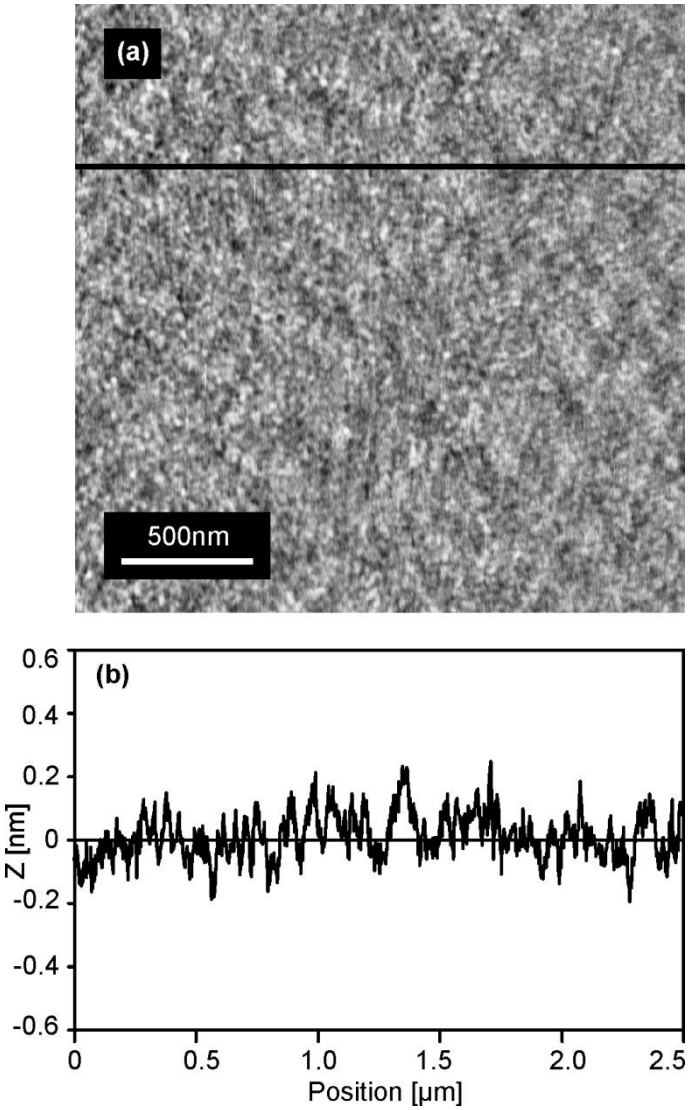

Figure 5: AFM measurements of IZO film obtained after annealing at 450 °C: (a) topography (z-scale 1.5 nm, RMS 0.2 nm); (b) height profile along the line indicated in (a).

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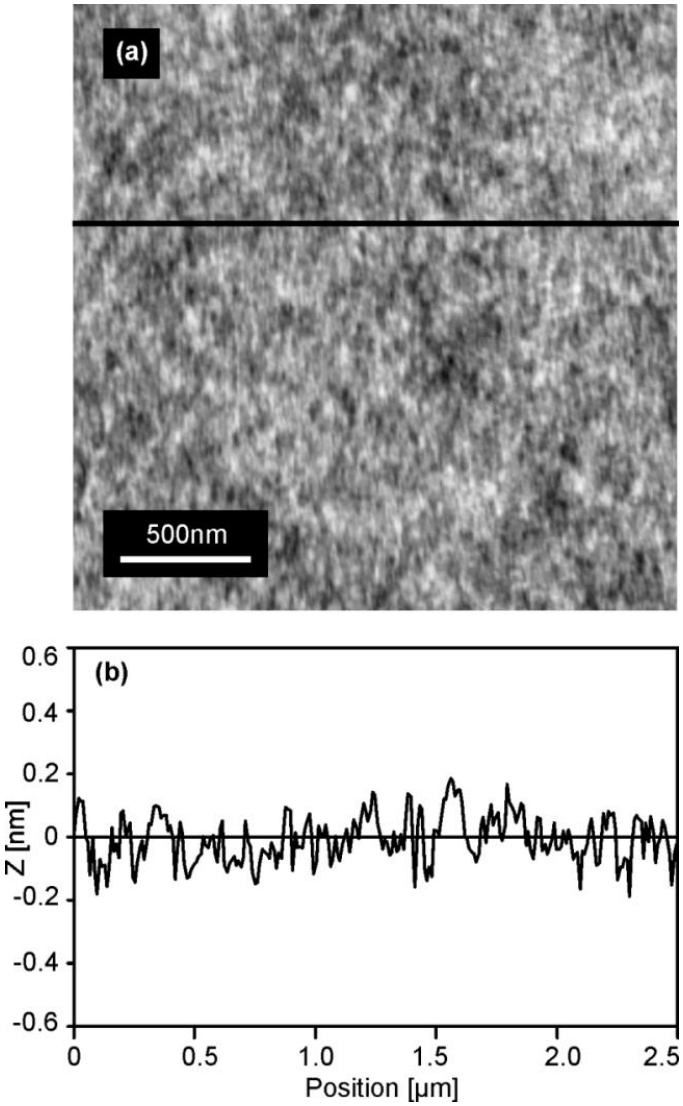

Figure 6: AFM measurements of IZO film in FET device after annealing at 250 °C and then at 450 °C. (a) topography (z-scale 1.8 nm, RMS 0.2 nm); (b) height profile along the line indicated in (a).

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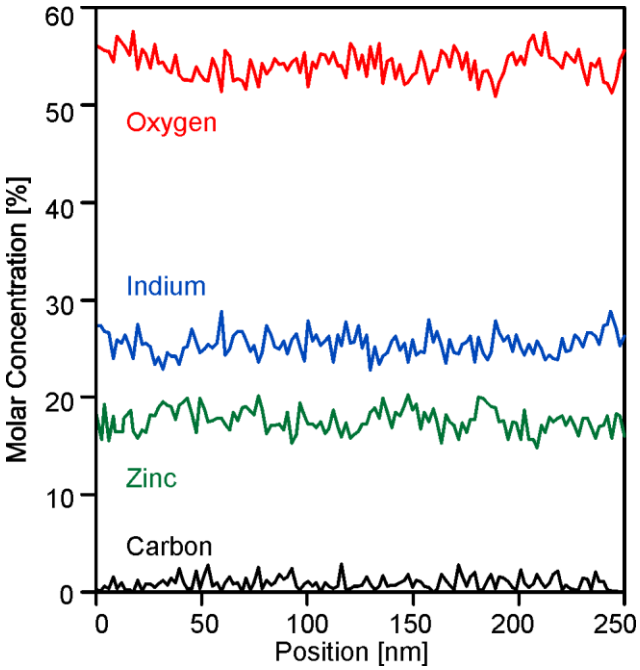

Figure 7: Auger line scan (128 data points) of an IZO film obtained after annealing to 450 °C of the In and Zn oximato precursors directly on a FET substrate.

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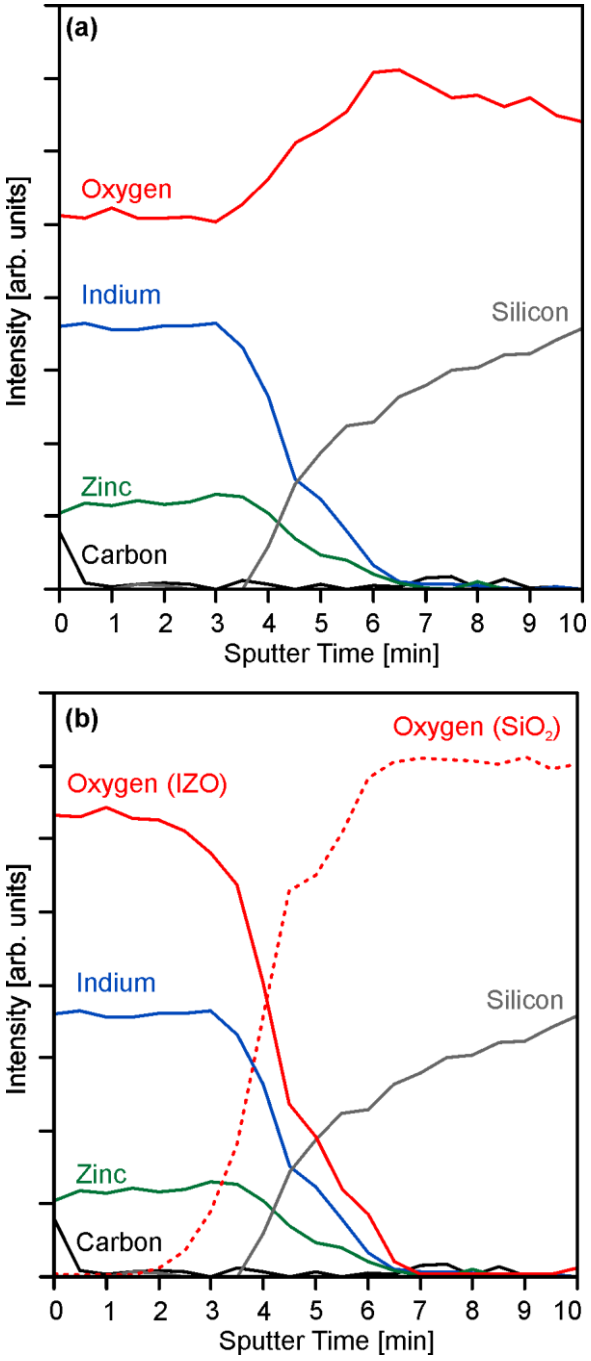

Figure 8: Auger depth profile (20 data points) of an IZO film on FET substrate prepared as described for Fig.7. (a) total oxygen contribution, (b) oxygen signals for IZO and SiO_2 indicated separately.

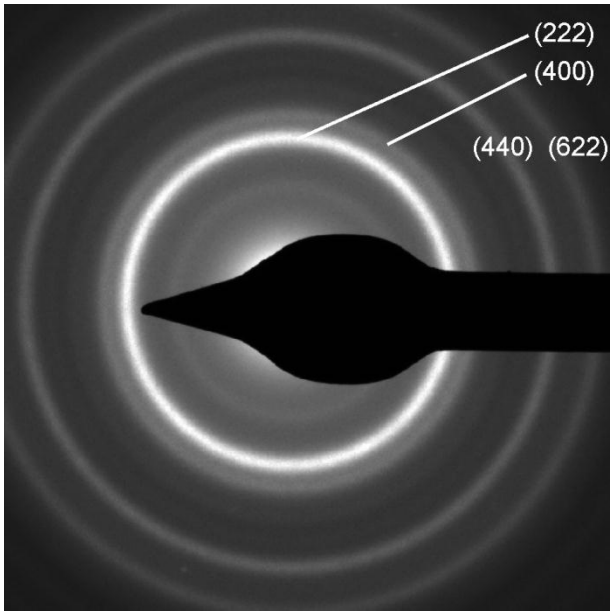

Figure 9: SAED pattern of IZO corresponding to the HRTEM images in Fig. 2c. The Miller indices refer to cubic indium oxide phase (bixbyite type).

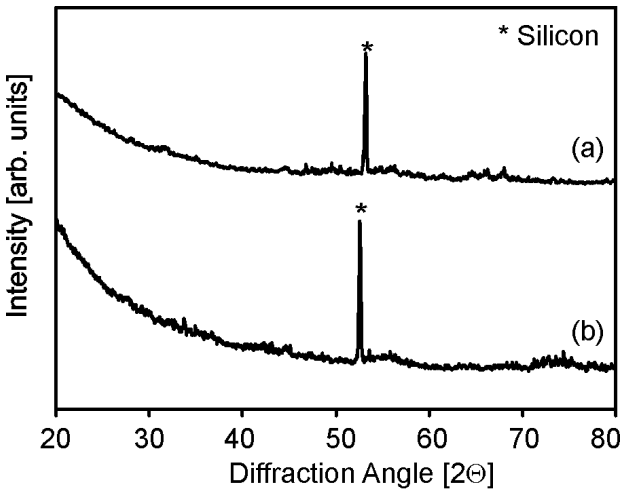

Figure 10: GI-XRD of (a) IZO film (15 nm) on silicon coated with silicon dioxide (230 nm) substrates. (b) silicon coated with silicon dioxide (230 nm) substrate as reference.

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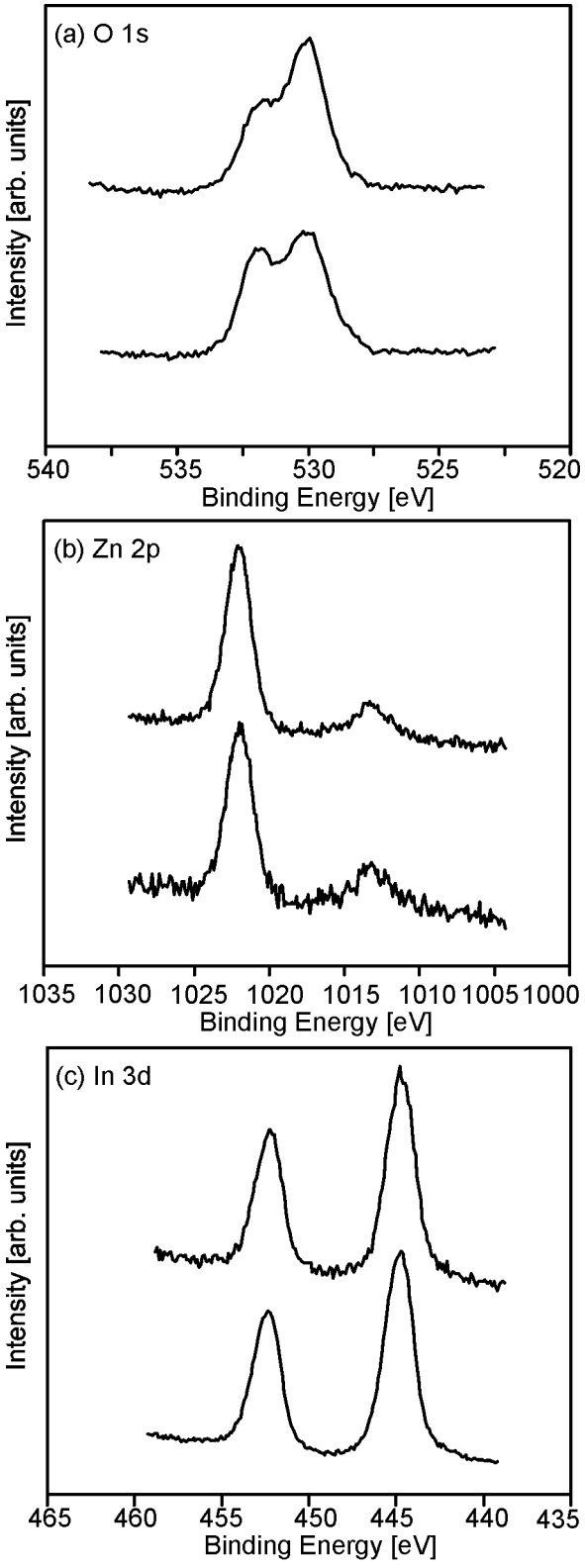

Figure 11: XPS spectra at (a) O 1s; (b) Zn 2p and (c) In 3d binding energies of IZO films obtained by annealing at 450 °C (above) and stepwise annealing at 250 °C followed by 450 °C (below).

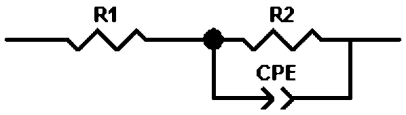

Figure 12: Equivalent circuit employed in the fitting procedure comprising a serial combination of a resistance and a parallel resistance/capacitance element.