SUPPORTING INFORMATION

Molecular precursors for ZnO nanoparticles: Field assisted synthesis, electrophoretic deposition and field-effect transistor device performance

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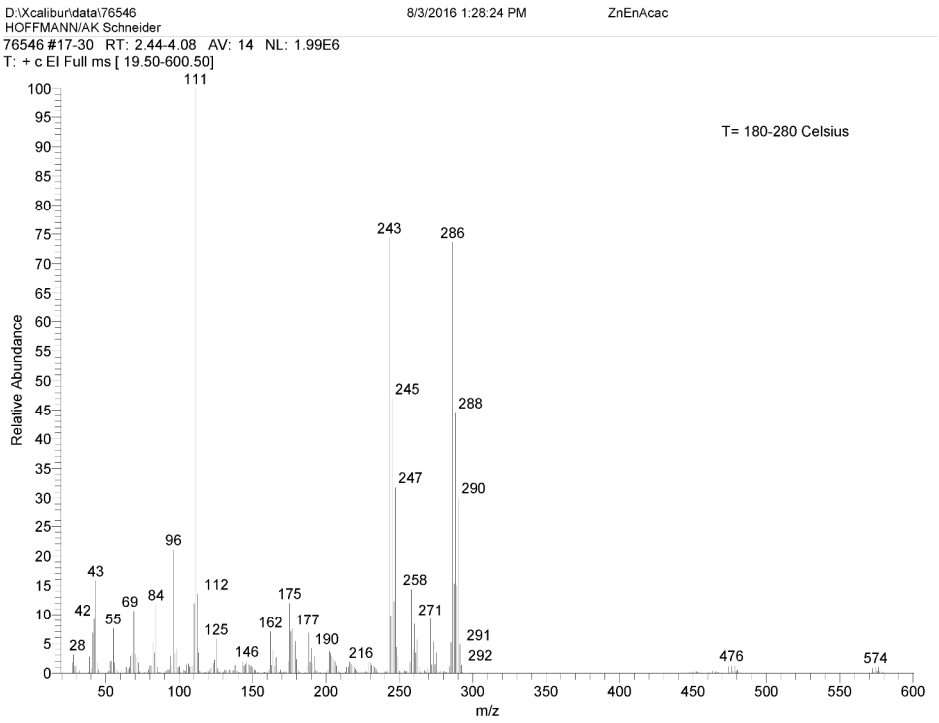
Characterisation

Thermogravimetry (TG-IR): TG209F1-Iris (Netzsch) coupled with a Nicolet iS10 IR spectrometer (ThermoScientfic). Samples were measured in oxygen at a heating rate of 10 °C/min in the range of 30 - 600 °C in aluminium crucibles. Dynamic Light Scattering (DLS): Zetasizer Nano (Malvern). Samples were measured in 10 mm quartz cuvettes. IR Spectroscopy: Nicolet 6700 (ThermoScientifc). Powders were measured with an attenuated total reflection (ATR) unit. X-Ray diffraction (XRD): Miniflex 600 (Rigaku), Cu-Kα radiation, 600 W in Bragg-Brentano geometry. High Resolution Transmission Electron Microscopy (HRTEM): Tecnai F20 (FEI) operated at 200 kV. Samples were supported on a lacey-carbon copper grid (300mesh). Ellipsometry measurements were carried out using a Nanofilm_ep3 (Accurion) with the modelling software provided by the manufacturer. Curve fitting for determination of the thickness of the ZnO layer was carried out using a three layer model (glass substrate with ITO and ZnO films). Scanning electron microscopy (SEM): Micrographs were obtained with an XL Series, Philips, XL30 FEG. Photoluminescence (PL): Spectra were recorded using a Fluorolog-3 (Horiba) with a Xenon lamp and an excitation wavelength of 275 nm. Auger depth profile: PHI 680 Xi Auger Nanoprobe. Area 1x1mm^2; sputter rate ~1 nm/min corresponding to SiO_2 reference sample. X-Ray Photoelectron Spectroscopy (XPS): XPS measurements were performed using a K-Alpha XPS spectrometer (ThermoFisher Scientific, East Grinstead, UK). All of the samples were analyzed using a microfocused, monochromated Al Kα X-ray source (30–400 mm spot size). The K-Alpha charge compensation system was employed during analysis, using electrons of 8 eV energy and low-energy argon ions to prevent any localized charge build-up. The spectra were

fitted with one or more Voigt profiles (BE uncertainty: ±0.2 eV). All of the spectra were referenced to the C 1s peak of graphite at 284.4 eV binding energy controlled by means of the well-known photoelectron peaks of metallic Cu, Ag, and Au.

Figure S1: (a) Mass spectrum (electron ionization) of (**1**) with masses in the range of m/z$^+$ 0 to 600 and (b) range of m/z$^+$ 420 to 600.

(a)



(b)

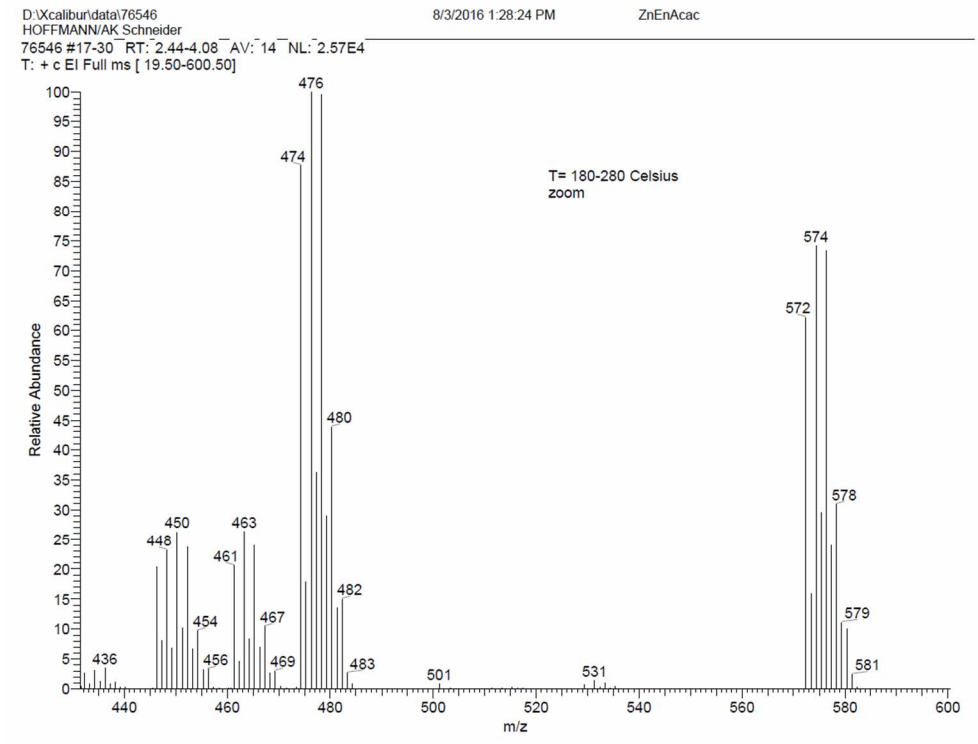


Figure S2: Mass spectrum (electron ionization) of (**2**).

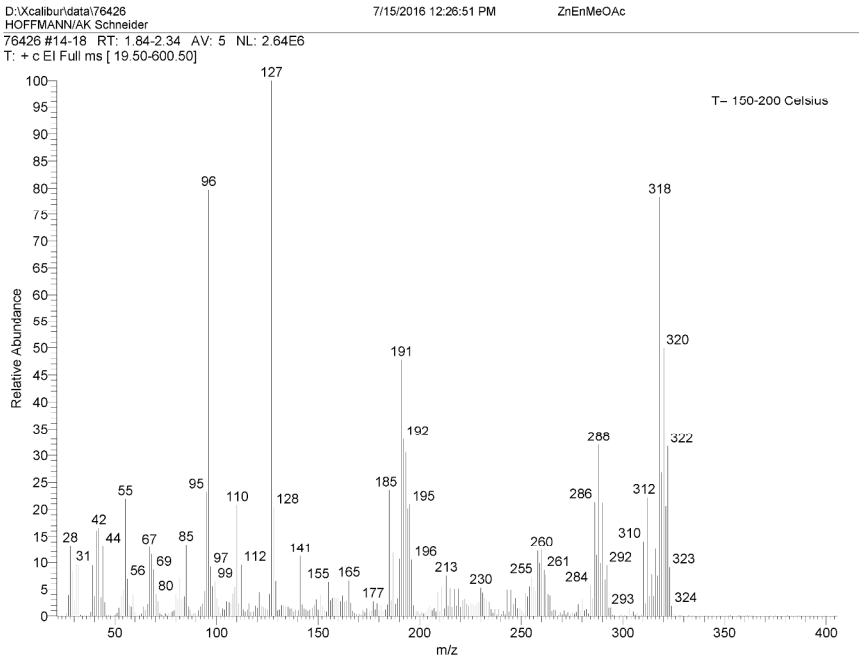


Figure S3: Gas phase IR spectra corresponding to (a) the first (I) and (b) the second (II) maximum of the Gram–Schmidt signal in Figure 1a from the decomposition of precursor (1) as well as reference spectra of (c) acetone; (d) third maximum (III) as well as reference spectra of (e) methane and (f) ammonia.

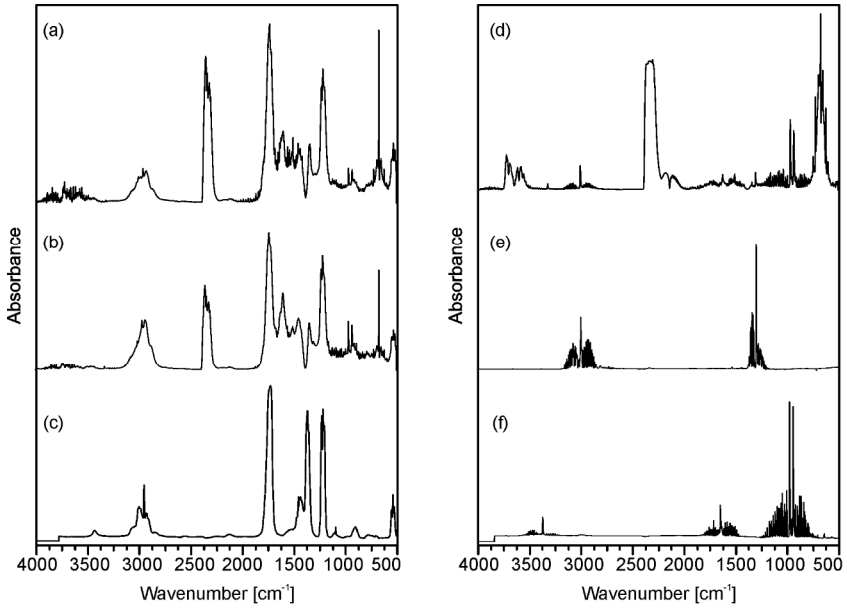


Figure S4: Gas phase IR spectra corresponding to (a) the first (IV) maximum of the Gram–Schmidt signal in Figure 1b from the decomposition of precursor (2) as well as reference spectra of (b) dimethylcarbonate and (c) methanol; (d) second (V) and (e) third maximum (VI) as well as reference spectrum of (f) ammonia.

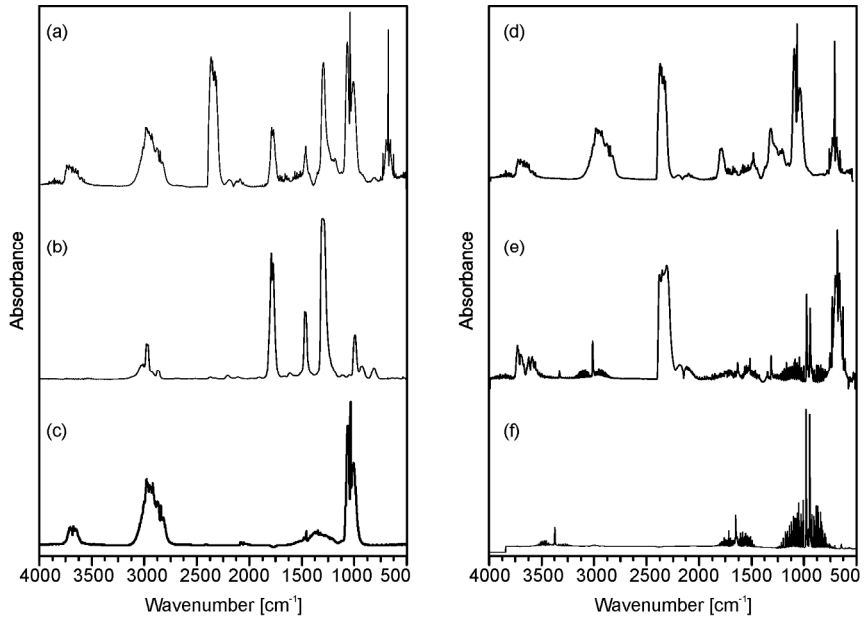


Figure S5: X-Ray diffractograms of the solid decomposition products in air of (a) precursor (1) and (b) precursor (2) after calcination at various temperatures.

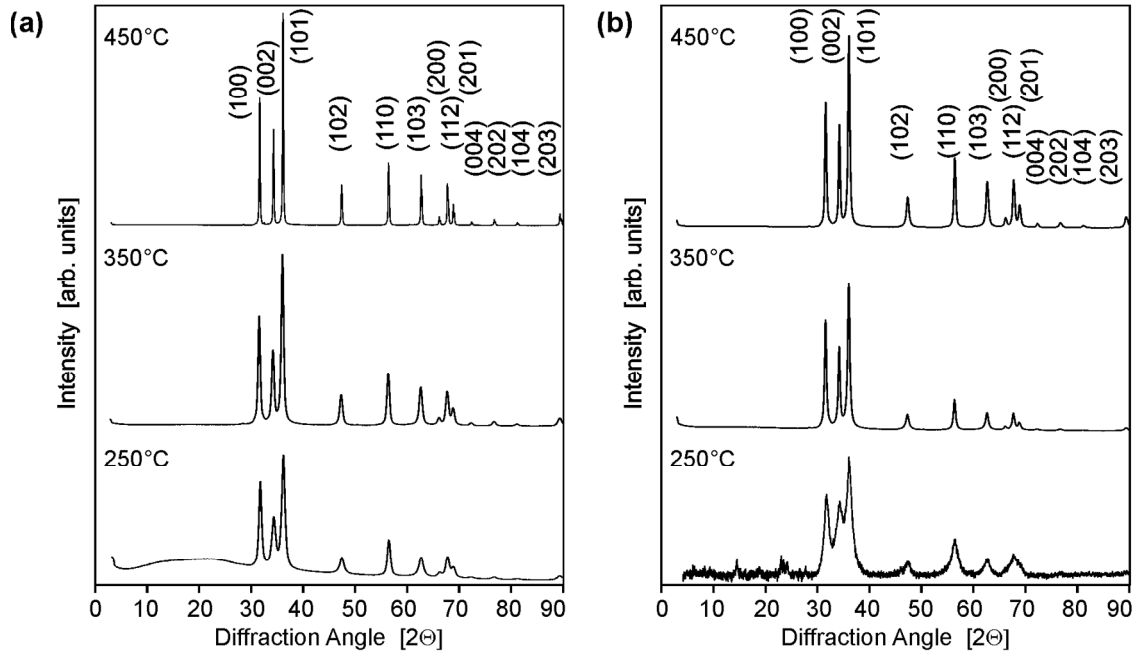


Figure S6: Temperature profile of the microwave-assisted decomposition of precursor (**2**).

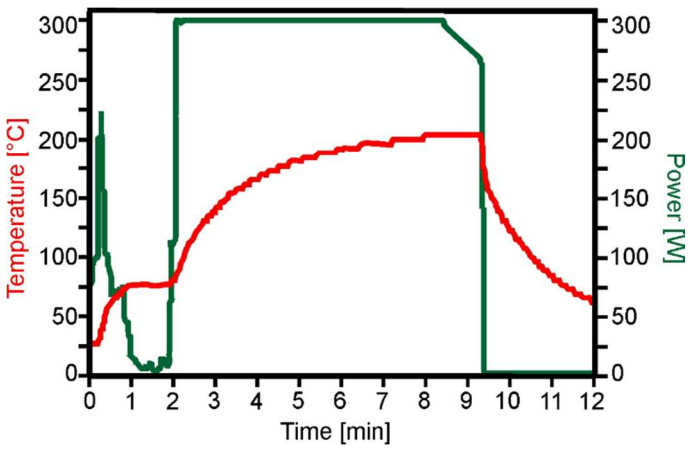


Figure S7: X-Ray diffractograms of the solid residues from the microwave-assisted decomposition of (**2**) obtained from different concentrations of the precursor.

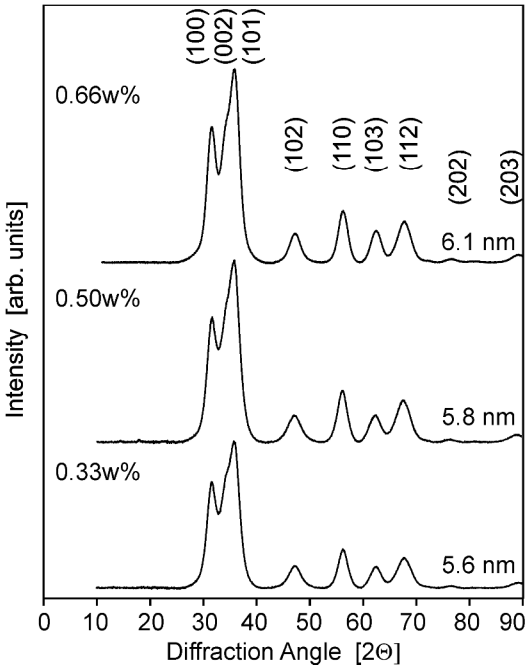


Figure S8. HRTEM image showing agglomerates of nanocrystalline zinc oxide obtained from microwave processing of precursor (**2**) with a concentration of 0.66 w%.

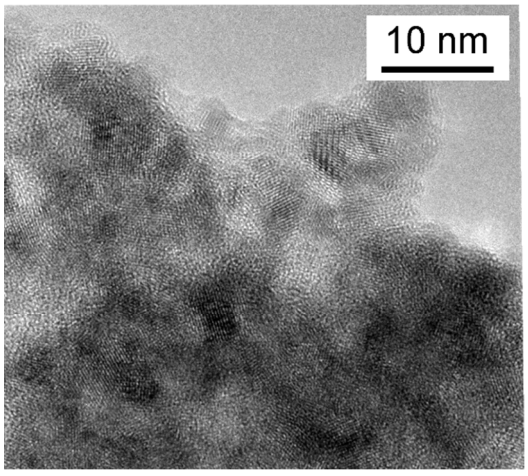


Figure S9: (a) Schematic presentation of FET. (b) SEM top view of the interdigital electrode arrangement. (c) SEM top view of the film from spincoating of ZnO particles synthesized by the microwave-assisted reaction of precursor (**2**).

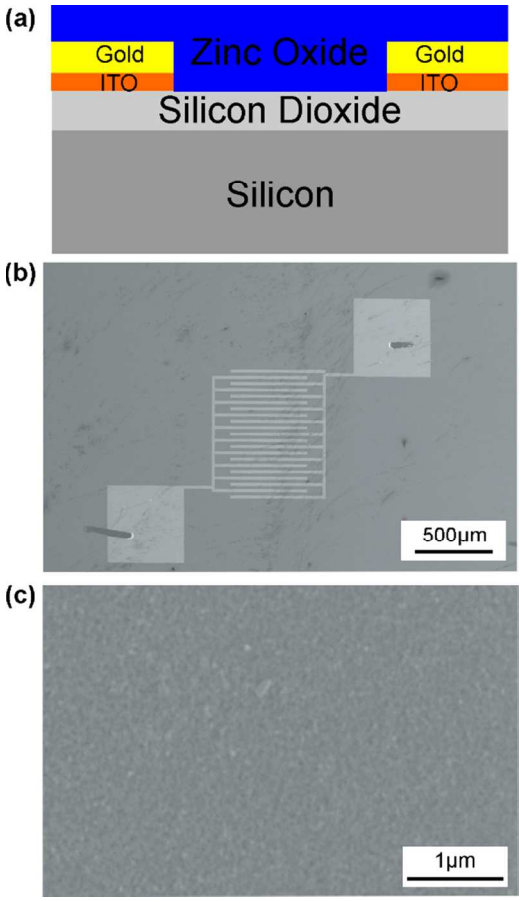


Figure S10: SEM top view of coatings obtained with a voltage of 40 V after (a) 60 min (b) 90 min as well as (c) 120 min.

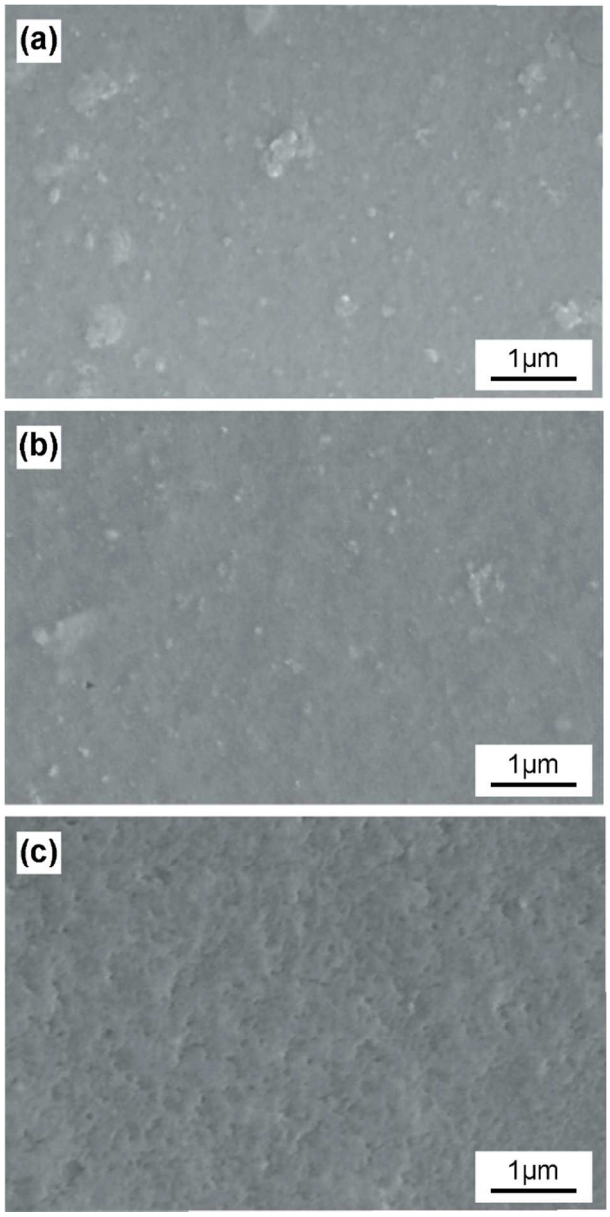


Figure S11: Photoluminescence spectra of ZnO films deposited by EPD at 40 V for 60 min from dispersions obtained from the microwave-assisted reaction with different precursor concentrations.

(* refers to omission due to contributions from the second harmonic of the excitation wavelength.)

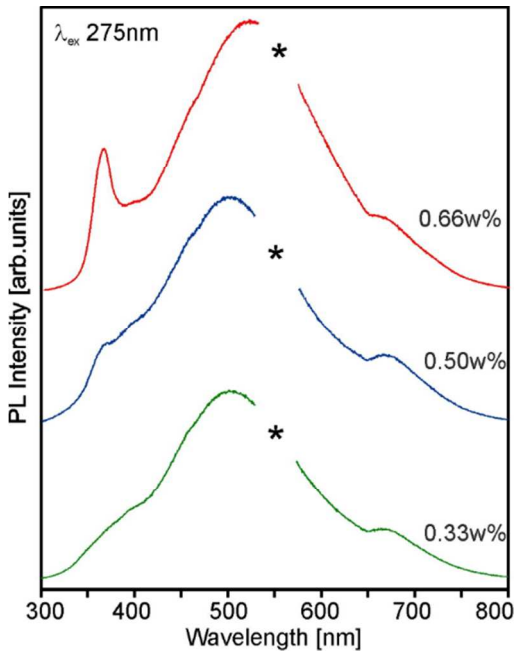


Figure S12: XPS spectra of a ZnO film deposited by EPD at 40 V for 120 min from dispersions obtained from the microwave-assisted reaction with a precursor concentrations of 0.50 weight%. (a) Zn 2p, (b) O1s, (c) C 1s and (d) N 1s region. Background corrected spectra are shown in black, whereas contributions from curve fitting procedure are presented in color (red, blue, green).