Aerosol-assisted route to Low-E transparent conductive gallium-doped zinc oxide coatings from pre-organized and halogen-free precursor.

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ELECTRONIC SUPPORTING INFORMATION

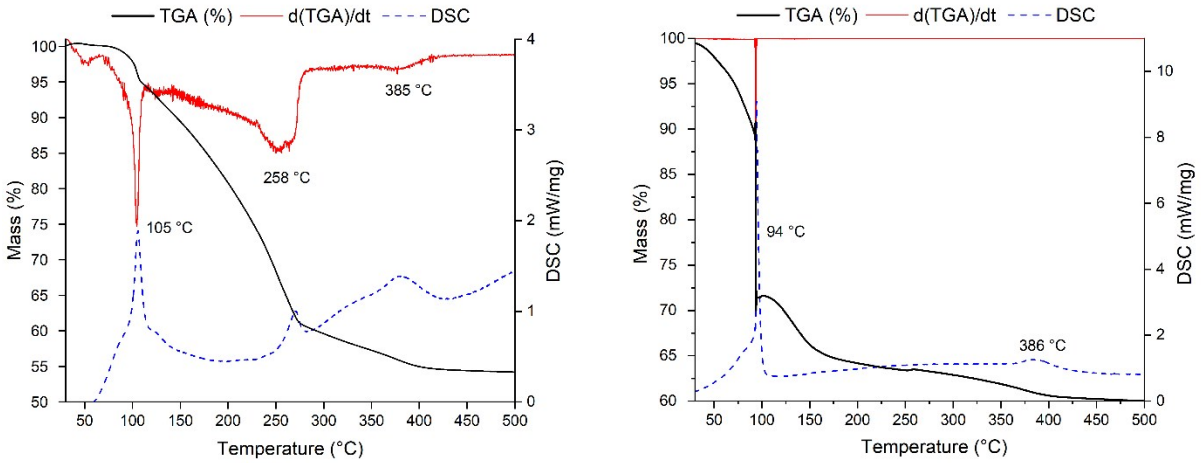

Figure S1. TGA(green)/DSC(blue) of precursor $[EtZnO^{i}Pr]_4$ under helium (left) and air (right). The red line represents the 1st derivative of the mass with time.

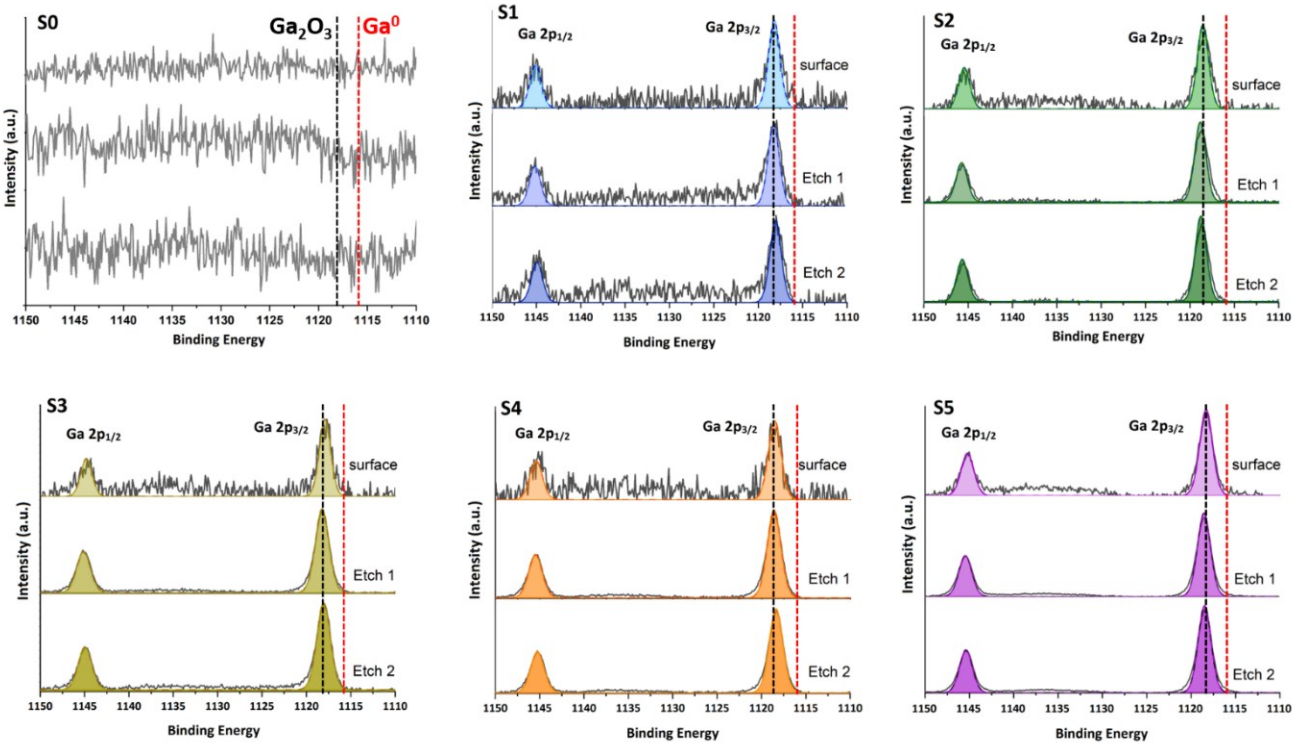

Figure S2. XPS scans of Ga 2p peaks of ZnO (S0) and GZO (S1-S5) thin films with increasing amounts of at% Ga. Vertical black lines indicate the literature value of Ga $2p_{3/2}$ for Ga^{3+} in Ga_2O_3 environment and vertical red lines indicate the literature value of Ga $2p_{3/2}$ for Ga^0 (metal).[1]

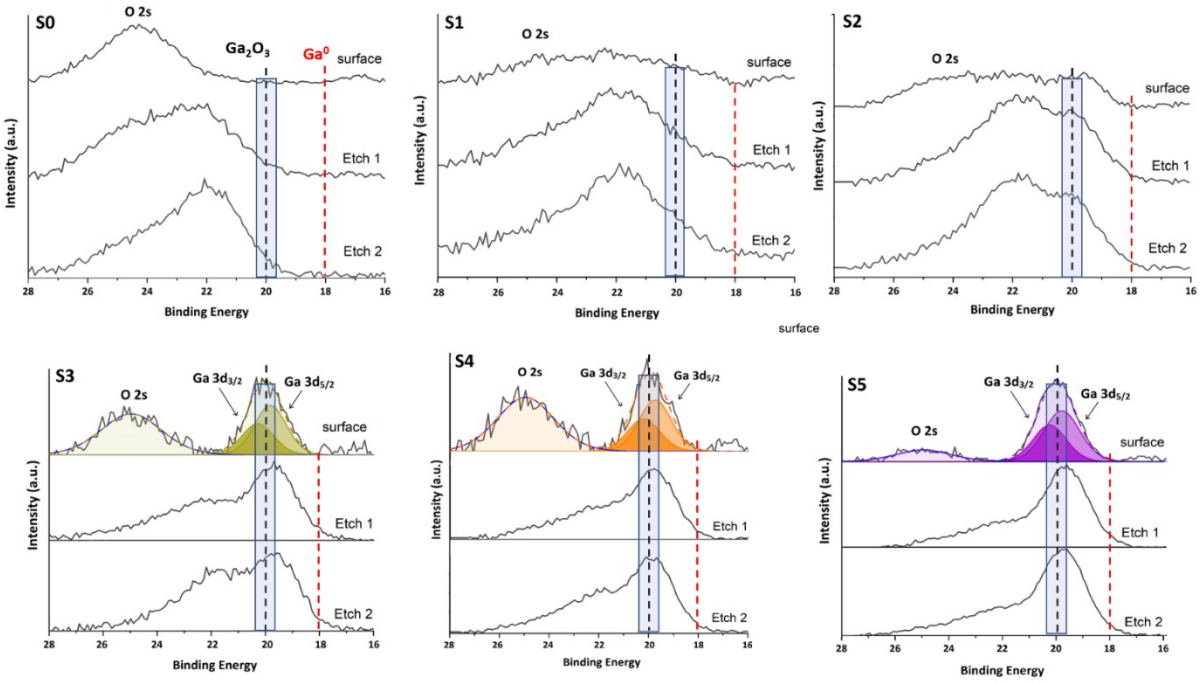

Figure S3. XPS scans of Ga 3d peaks of ZnO (S0) and GZO (S1-S5) thin films with increasing amounts of at% Ga. Vertical black lines indicate the literature value of Ga $3d_{5/2}$ for Ga^{3+} in Ga_2O_3 environment[2] (blue rectangle shows error of 0.2 eV) and vertical red lines indicate the literature value of Ga $3d_{3/2}$ for Ga^0 (metal).[1]

Equation S1. Equation used to calculate the texture coefficient for each plane

$$TC(hkl) = [I(hkl)/I_0(hkl)] \,/\, [(1/N)*\sum\{I(hkl)/I_0(hkl)\}]$$

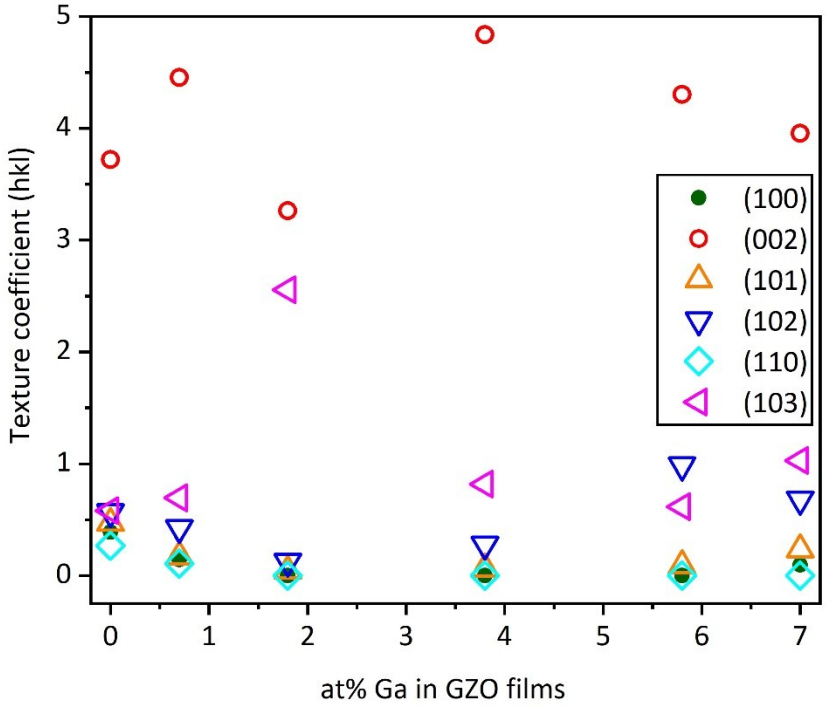

Figure S4. Texture coefficients for ZnO and GZO films with 0.7 – 7.0 at% Ga.

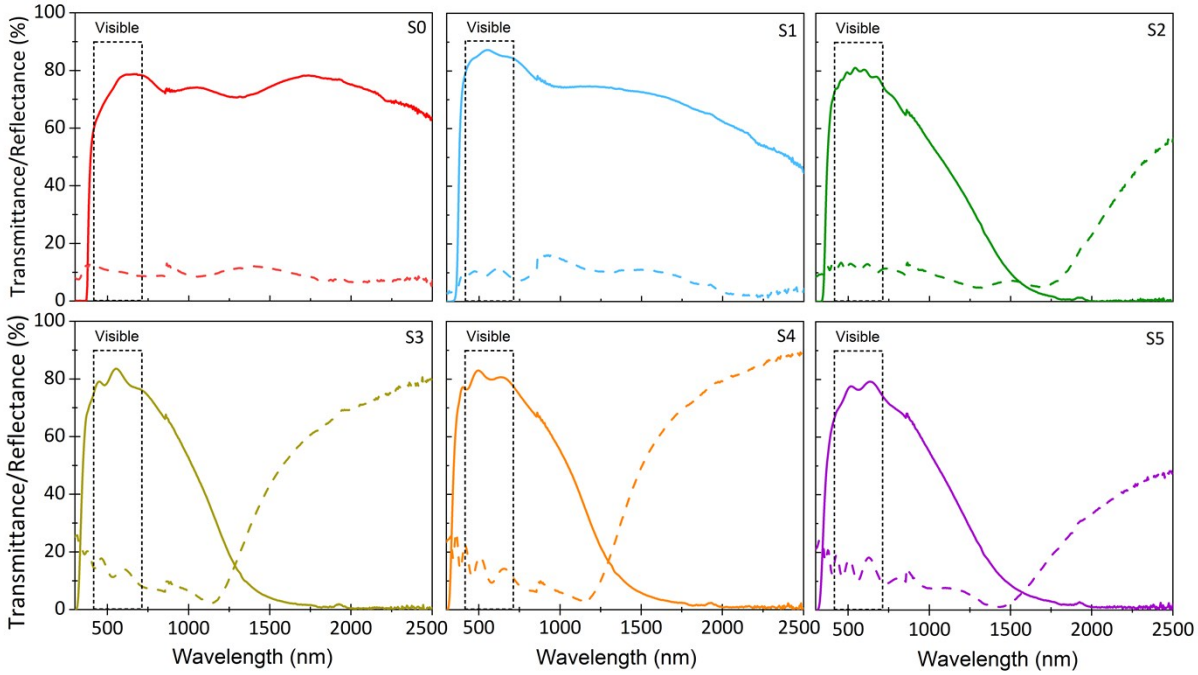

Figure S5. Optical transmission and reflection spectra of undoped ZnO (S0) and gallium-doped ZnO thin films with increasing at% of Ga (S1 – S5).

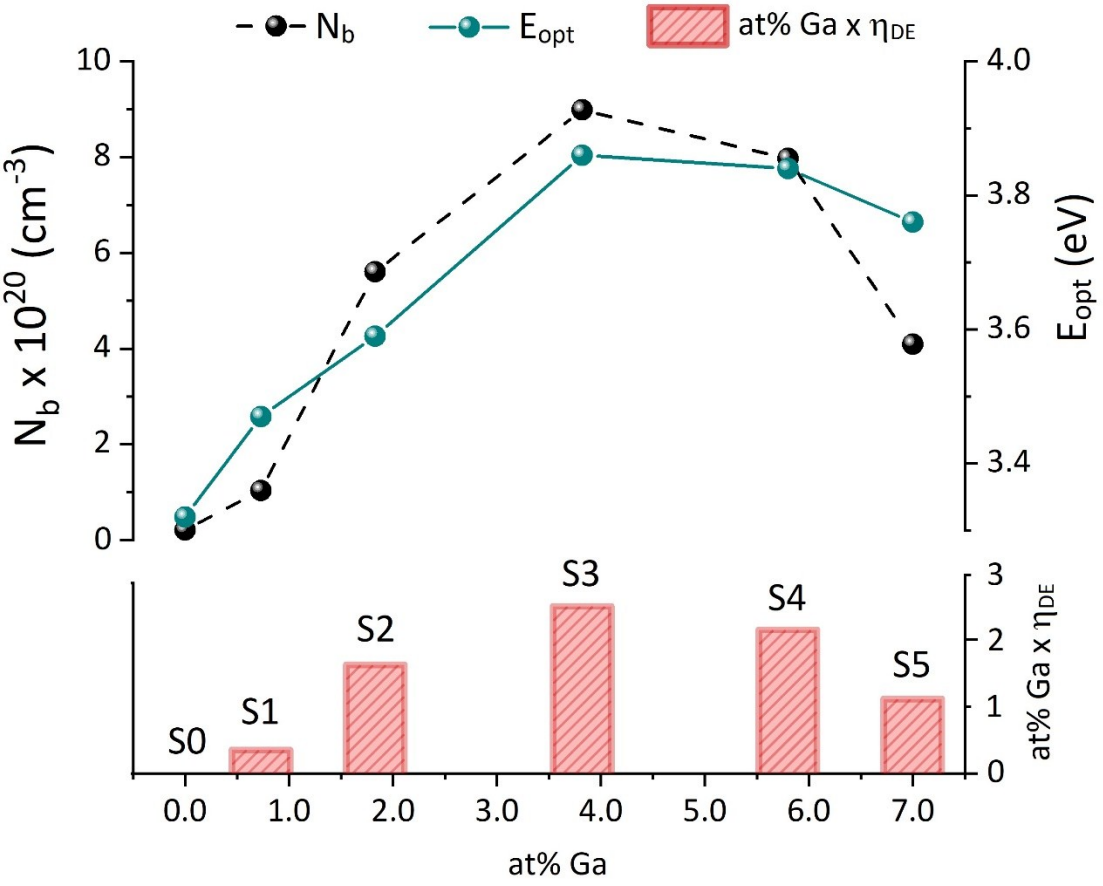

Figure S6. Relationship between carrier concentration (N_b) and band gap enhancement of GZO, in comparison with total amounts of gallium incorporated as dopant (at% Ga x η_{DE}) for each level of at% Ga.

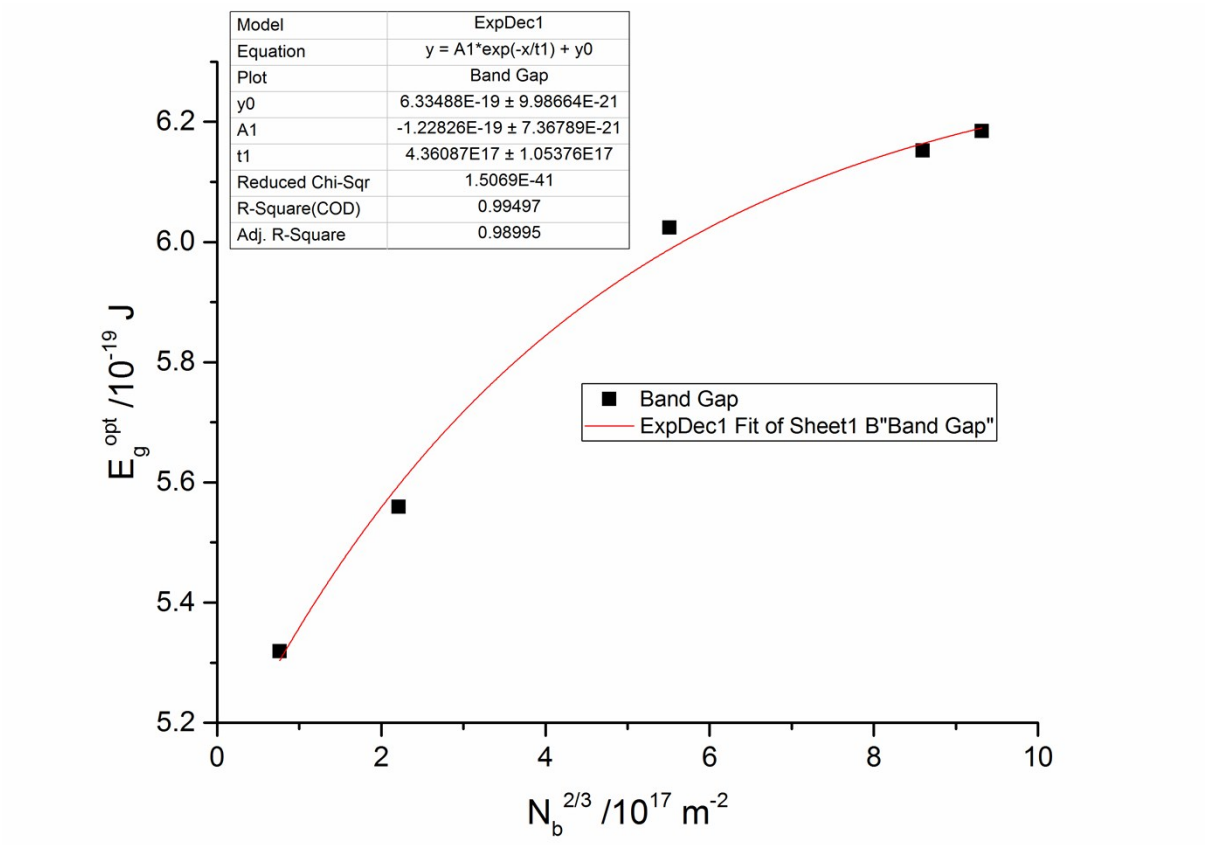

Figure S7. Representation of E_g vs $N_b^{2/3}$ for thin films S0 – S5.

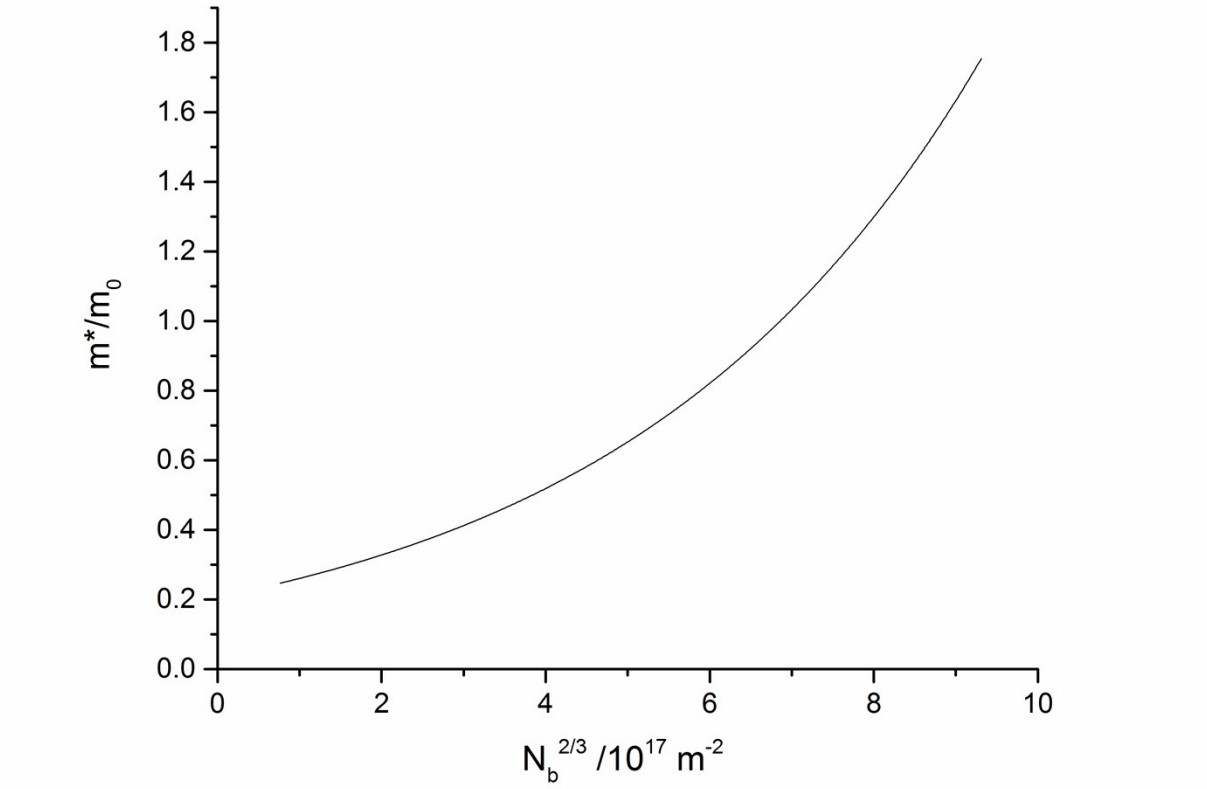

Figure S8. Representation of effective mass m^*/m_0 vs. $N_b^{2/3}$ for thin films S0 – S5.

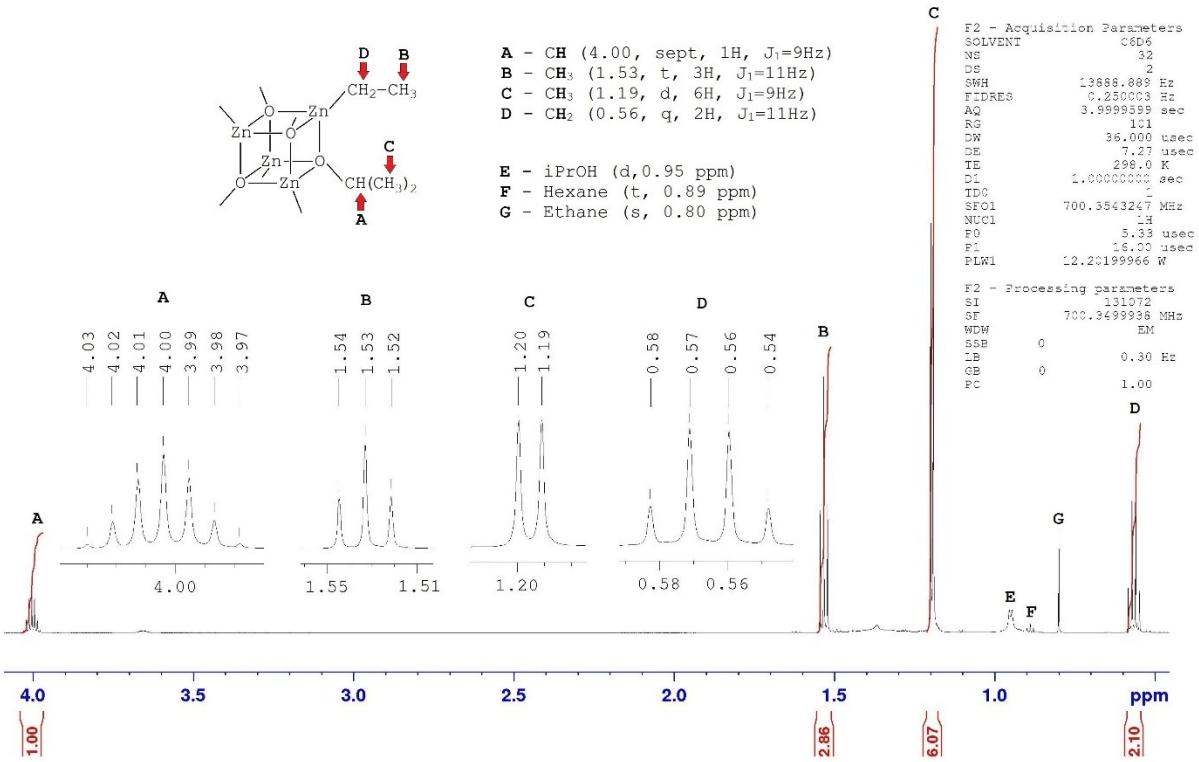

Figure S9. ^{1}H NMR of precursor $[EtZnO^{i}Pr]_4$ in C_6D_6.

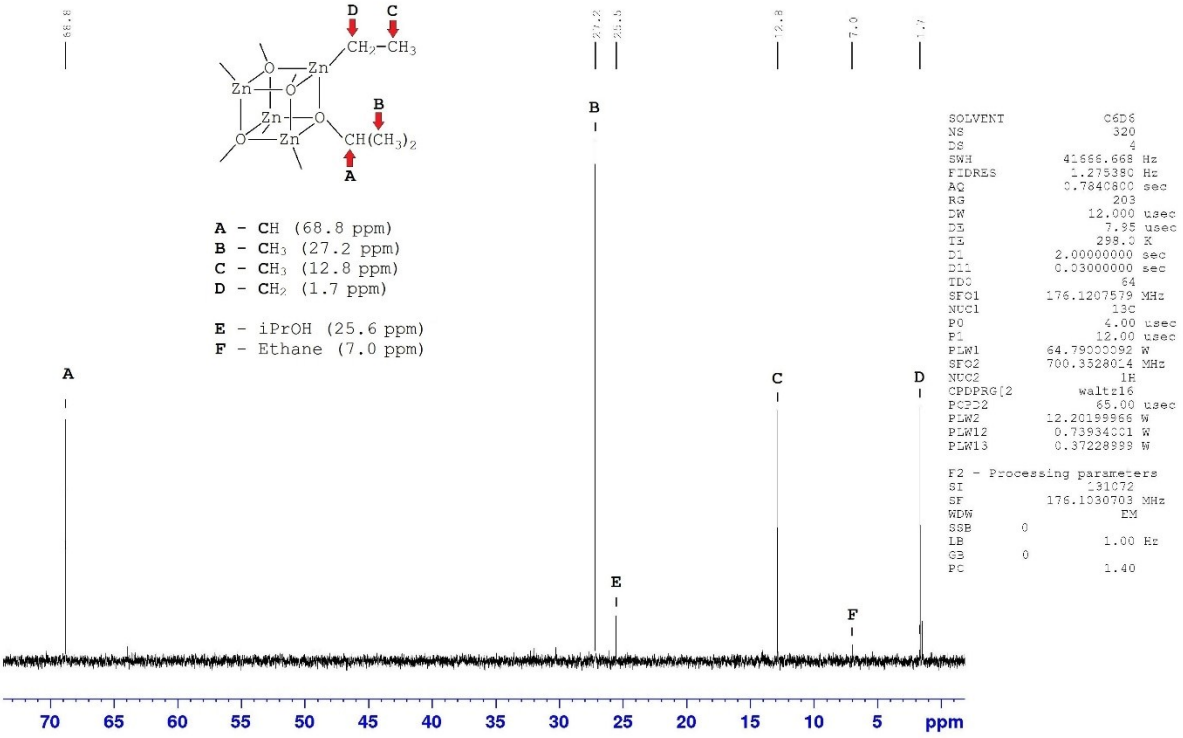

Figure S10. $^{13}C\{^{1}H\}$ NMR of precursor $[EtZnO^{i}Pr]_4$ in C_6D_6.

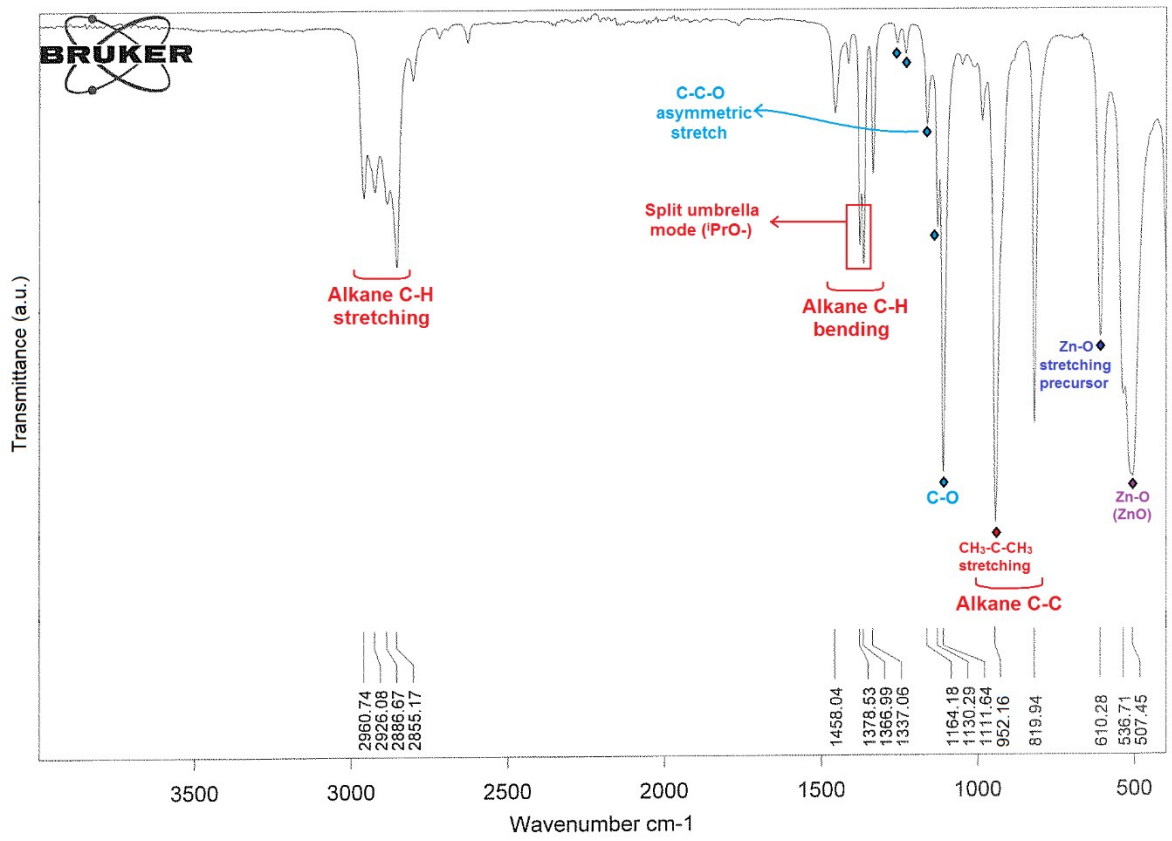

Figure S11. FTIR of precursor $[EtZnO^{i}Pr]_4$.

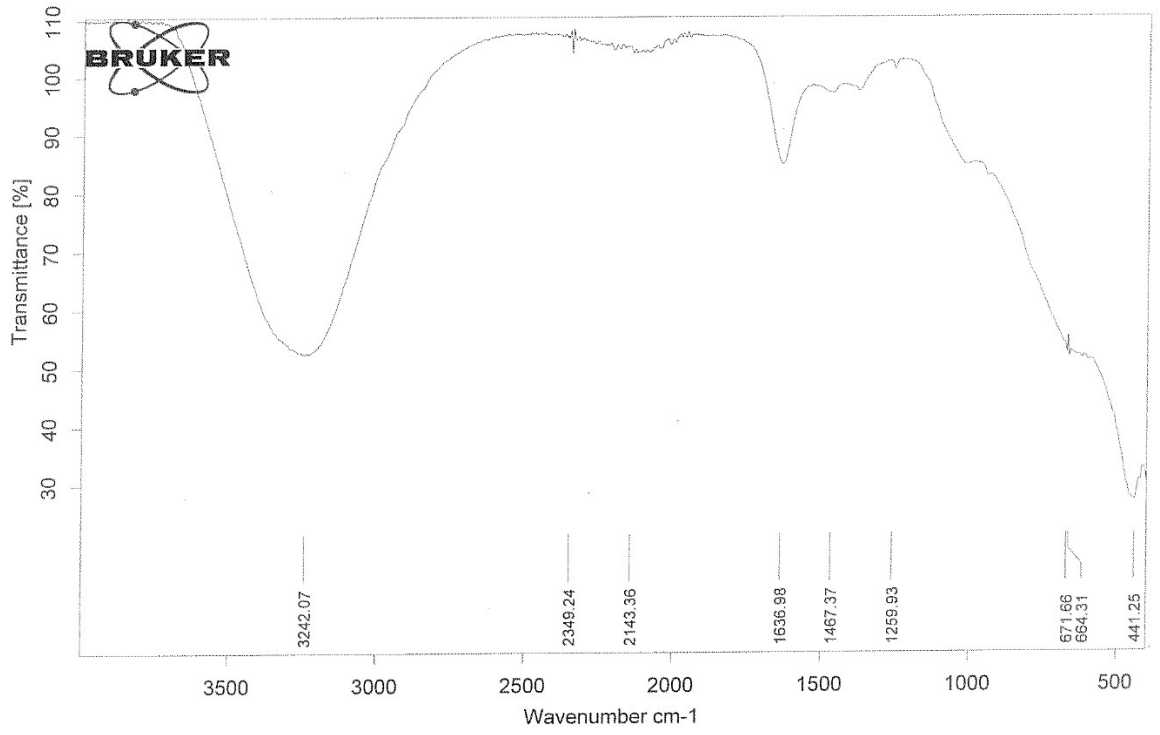

Figure S12. FTIR of hydrolysed precursor $[EtZnO^{i}Pr]_4$.