# Characterizations of Structural Properties of ZnO Thin Films Depending on the Experimental Conditions

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Zinc oxide (ZnO) is one of the most promising materials for the fabrication of optoelectronic devices operating in the blue and ultra-violet (UV) spectral regions, owing to its direct wide band gap ($E_g$ ~3.37 eV) and large exciton binding energy (~60 meV).

ZnO films were grown in horizontal vent-run-type metalorganic chemical vapor deposition (MOCVD) reactor (Quantax 226, refurbished by EMF Ltd) at atmospheric pressure. Samples were obtained on r-axis-oriented sapphire (r-$Al_2O_3$). The growth time of ZnO was from 5 to 90 min in the temperature range 300-400 $^0$C (step of 25 $^0$C). Diethylzinc (DEZn) and tertiary butanol (tBuOH) were used as the Zn and O precursors, respectively. N2 used as carrier gas. The molar flows of DEZn and tBuOH through the reactor were fixed at 14.2 and 70.9 μmol/min, respectively.

The object of this study was to find the optimum temperature and the minimum time in which is possible to obtain a film with a smooth surface and with a minimum thickness, for the possibility of future use of these films as buffer layers in the ZnO/CdO sandwich structure.

Initially the deposition was constant and amounted 90 minutes. Studies have shown that the optimum temperature at which all samples were with a smooth surface was 375 $^0$C. This temperature was chosen for further studies. The thickness of thin films was 190-225 and 510-560 nm depending on the location in the reactor (R- i F-groups, respectively).

With decreasing of deposition time was found that beginning on 15 min of deposition time, only samples that were located closer to the entrance of flow into the reactor (F-group) had a smooth surface and thickness 70-100 nm, depending on the position of the sample. Further reducing of the deposition time showed that only FC i FR samples were smooth and with 5 min of deposition their deposition thickness was 42-45 nm.