

# Characterization of MBE grown Indium Oxide layers and Indium Tin Oxide nanowires

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Transparent conductive oxides (TCO) show a high optical transmittance due to their wide bandgap and are electrically conductive. Indium tin oxide (ITO) is a prime candidate because in comparison to other TCO it combines a high optical transmissivity, low resistivity and long term stability.

For a novel type of CdTe/CdS thin film solar cell, epitaxially grown indium tin oxide (ITO) layers are to be used as front contacts. By growing a solar cell with high quality crystalline layers, it is expected to develop more insight into the factors that promote high efficiencies.

Indium oxide layers and indium tin oxide nanowires were grown on quartz glass and (111) oriented yttria-stabilized-zirconia (YSZ) substrates by plasma-assisted molecular beam epitaxy. The decision to grow ITO ( $a = 5,1423 \text{ \AA}$ ) on YSZ ( $a = 10,1170 \text{ \AA}$ ) was made in order to reduce the misfit to only 1,6 % and therefore enhance the structural perfection and material properties of the layers. The surface morphology was characterized by an atomic force microscope (AFM) and scanning electron microscope (SEM). The optical transmittance was observed with an UV-Vis-NIR spectrophotometer. Hall and Van-der-Pauw measurements were made in order to describe the resistivity, mobility and charge carrier concentration. The orientation of the grown layers was determined by electron backscatter diffraction (EBSD) and X-ray diffraction (XRD). The elemental composition was investigated by secondary ion mass spectroscopy (SIMS). It has been deemed that ITO nanowires instead of regular layers grow, when an elevated oxygen flow is applied during growth.