TCO-deposition of ZnO by the LP-CVD Technique for Applications in Thin Film Amorphous Silicon Solar Cells

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This presentation introduces and presents the LP-CVD (Low Pressure Chemical Vapor Deposition) technique as used here for deposition of Zinc oxide (ZnO) layers. In this process Diethylzinc and water vapour react chemically on the substrate surface at temperatures of around 200 °C under reduced pressure. Addition of small amounts of diborane to the process vapour phases allows doping of the deposited ZnO material; this leads to highly conductive transparent conductive oxide (TCO) layers.

Layers with excellent surface texture can thereby be obtained under selected growth conditions without any post-treatment at growth rates of around 20 Å/s. Specular and diffuse optical transmission measurements confirm the light scattering capability and the high optical transmission of this material. These layers have been further analysed by secondary electron microscopy, X-ray diffraction spectroscopy and conductivity measurements. Results of these measurements will be presented.

Finally, the fabricated ZnO layers are compared with the best commercially available SnO_2 layers (Asahi type U) as a front TCO in p-i-n single-junction amorphous silicon solar cells. An enhanced spectral response compared to Asahi U proves the enhanced light trapping potential for this as-grown, natural textured ZnO material deposited

by the LP-CVD technique. In the light-soaked state p-i-n single-junction amorphous silicon solar cell efficiencies of 9 % have been obtained.

Literatur

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