

# Chemical and Optical Characterisation of Photovoltaic Thin Film Materials by Glow Discharge Optical Emission Spectrometry

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Photovoltaic (PV) thin film (TF) materials can allow a dramatic reduction of PV energy costs due to less extensive material usage, easier manufacturing processes and higher efficiencies (1). To develop TF-materials and production processes, new characterisation methods are needed to understand the intercorrelation between material properties and module quality (2). These methods should as well be applicable for industrial quality control since successful PV materials will always have to be produced on large scales. Therefore, convenient characterisation methods have to be fast and efficient. Glow discharge optical emission spectrometry (GD-OES) is a well established, fast and easy to use means to analyse thin films. Thus, the potential of GD-OES for the analysis of thin transparent films for PV applications was investigated in an exemplary study.

In the study, it could be shown, that it is possible to analyse the chemical composition of thin transparent films by GD-OES. In addition, an interferometry based method (3) was applied to determine the refractive index of the layers for several discrete plasma emission lines at the same time. It turned out, that the accuracy of the found refractive indices is comparable to the values found by ellipsometry. In Al-doped ZnO layers the correlation between dopant concentration and refractive index could be studied as well as the wavelength dependence of the refractive index. The simultaneous determination of optical and chemical properties of thin films is particularly interesting for PV. The study shows, that GD-OES has a high potential to serve as a production near analysis tool in PV TF industry.

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