

Sol-gel Processed Niobium-doped Titanium Dioxide as Substitute for Indium Tin Oxide in Transparent Conductive Coatings

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Indium tin oxide (ITO) is the current industrial standard for transparent conductive coatings (TCCs). However, as a result of the limited availability and the volatile price of indium an alternative is critically needed. Materials based on titanium dioxide are attracting significant interest, due to their band gap energy lying in the UV wavelength region and their transparency for visible light. When suitably doped with a second metal, titanium dioxide provides high conductivity and transparency. In this work, niobium doped titanium dioxide has been identified as a possible substitute for ITO.

With conventional methods -such as sputter coating- showing significant limitations in cost and process efficiency, the sol-gel method was chosen as a processing route. Major advantages are its simplicity, flexibility and the possibility to work under ambient temperature and pressure.

The influence of different precursor concentrations and doping levels on the sol-gel process has been investigated. The formation of the TiO₂-matrix was studied via FTIR, light microscopy and SEM/EDX were used to investigate film formation capabilities as well as possible agglomeration of the dopant in the coating. TGA/DSC provided information about the optimisation of the sintering process and the formation of the desired anatase crystal structure was controlled with XRD.

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