

Niobium-doped Titanium Dioxide Transparent Conductive Coatings via the Sol-gel Method

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Materials based on titanium dioxide, especially anatase, have attracted much scientific interest as transparent conductive oxides due to their bandgap energy lying in the UV wavelength region and their relatively low price compared to indium tin oxide (ITO). When suitable doped with a second metal, TiO₂ demonstrates high electrical conductivity and transparency, [1] thus making it a promising material for the substitution of ITO in high integrity transparent conductive coatings (TCCs). In this study, niobium-doped TiO₂ was identified as a possible alternative for ITO.

The development of a sol-gel processing route for depositing indium-free TCCs in ambient air will be discussed in this work. Different doping levels and solvent concentrations were analysed regarding their influence on the sol-gel reactions. The formation of a cross-linked TiO₂-matrix was investigated using FTIR, film formation and distribution of niobium in the thin films were analysed via light microscopy and SEM/EDX respectively. TGA was used to study the sintering behaviour and the crystallisation sequences were investigated with XRD.

Preliminary results from this study will be discussed. This work has been carried out as part of the INFINITY project, which has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 641927.

[1] D. S. Bhachu, S. Sathasivam et.al., *Adv. Funct. Mater.*, 24, 5075 (2014).