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Abstracts

Nonaqueous Synthesis of Indium Tin Oxide Nanocrystals

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Abstract – Indium Tin oxide nanoparticles with tin oxide content nearly 15 wt% have been synthesized via a nonaqueous sol-gel route, under solvothermal treatment of indium acetylacetonate and tin tert-butoxide in benzyl alcohol. The synthesis leads to near spherical nanoparticles, highly crystalline, with sharp distribution and average size of 8 nm. The material thus obtained appears as a good alternative to film formation by soft chemical methods, due the regular morphology and distribution.

The technological interest in transparent conductive oxides (TCOs) has motivated several works in processing techniques to obtain adequate routes synthesis. TCOs are important materials for optoelectronic devices, because they combine optical transparency in the visible region with controllable electrical conductivity. Commercially available techniques in production of TCO are based in high-temperature deposition methods (spray-pyrolysis) and generally, these aren't capable to a good thickness control, leading sometimes to high particle size or irregular morphologies. Efforts in produce those oxides – SnO₂:Sb, SnO₂:F and ITO (In₂O₃:Sn), the most widely used TCO in optoelectronics, among others – by soft chemical routes were expend, in order to obtain low temperature processing of the desired devices^[1,2]. Also, soft chemical routes are considered promising to fulfill most of the requirements such as high crystallinity, purity, good yields and good control from the molecular precursor to the final product and general applicability.

This work presents a nonaqueous sol-gel method to obtain near-monodisperse indium tin oxide nanocrystals. The experimental procedure consists in a one pot reaction, initiated by the addition of an organometallic precursor (indium acetylacetonate and tin tert-butoxide) into on benzyl alcohol, following by solvothermal treatment at 200°C for about 48h. ITO particles were collected by centrifugation, washed twice with tetrahydrofuran (THF), and dried at 60°C for 12h in air^[3]. The entire product presented a well crystallized structure (Fig. 1a), revealed by XRD peak width, with small particle size in the range of 5-12nm (Fig.1b and 1c). The synthesis product showed stable as a colloid by re-dispersion in THF, that allows the deposition of thin films in the same way of previous study with Sb:SnO₂ films^[4]. The solvothermal reaction between the organometallic compounds above in benzyl alcohol provides a comfortable nonaqueous route to crystalline indium tin oxide nanoparticles with uniform spherical shape and sizes in the range of 5-12 nm.

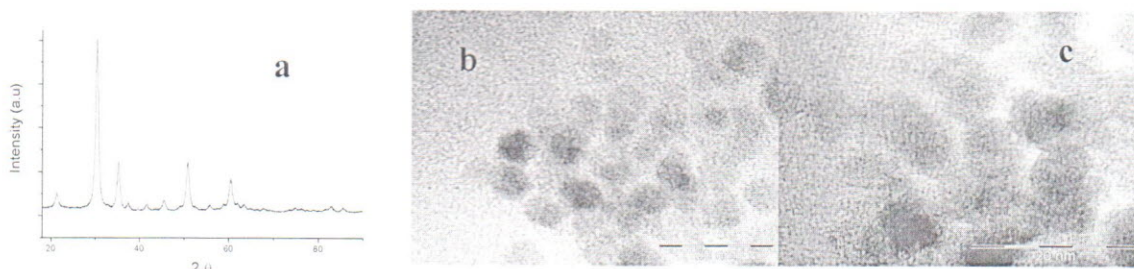


Figure 1: a) XRD pattern for ITO nanocrystals; b and c) HRTEM images for the synthesized indium tin oxide.

References

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