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Order and Disorder in Multicomponent Passive and Active Oxides

R. Martins, L. Pereira, P. Barquinha, I. Ferreira, R. Prabakaran, G. Gonçalves, A. Gonçalves, E. Fortunato
Materials Science Department, CENIMAT/I3N, Faculty of Science and Technology of New University of
Lisbon and CEMOP/UNINOVA, Campus de Caparica, 2829-516 Caparica, Portugal

This presentation discusses the effect of order and disorder on the electrical and optical performance of multifunctional oxides, to be used either as Transparent Conductive Oxides (TCO) or as Active Semiconductor Oxide (ASO) thin films in electronic devices such as pn heterojunction solar cells and thin-film transistors. The role of the spherical symmetry of the s electron conduction bands will be analyzed concerning the expected conduction mechanism in ordered and disordered semiconductors and compared to what happens in covalent semiconductors. The results obtained show p-type c-Si/a-IZO/poly-ZGO solar cells exhibiting efficiencies exceeding 14% in device areas of about 2.34 cm² and amorphous oxide TFTs based on the Ga-Zn-Sn-O system with superior performance than the one of polycrystalline TFTs based on ZnO, translated by I_{ON}/I_{OFF} ratio exceeding 10⁷, turn-on voltage below 1-2 V and saturation mobility above 25 cm²/Vs. Apart from that, preliminary data on p-type oxide TFT based on the Zn-Cu-O system will also be presented.