**Hydrogenated Indium oxide-based TCOs with improved electro-optical properties**

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Indium-based oxides are considered as attractive materials for transparent conductive oxides (TCO); its multi-functionality, excellent optoelectronic properties, high transmittance and good electric conductivity for application in solar cells, electrochromic windows, field emission displays, or light-emitting diodes.

Hydrogen is known as amphoteric impurity in semiconductors; however, in the recent past lot of work have been made using indium oxide (In2O3) and it was shown that the introduction of H2 in the films (e.g. during the sputtering process or even in post-deposition treatments) leads to the improvement of optical and electrical properties, as high near-infrared transparency and high mobility, exposing the non-amphoteric role of the H2 in this oxide.

In this work, we report on the production of hydrogenated In2O3-based thin films deposited by rf reactive magnetron sputtering varying oxygen-hydrogen dilution in the gas mixture. In situ hydrogenated In2O3-ZnO films (IZO:H), the transparency and conductivity can be improved with the addition of O2 and H2 to the sputtering atmosphere, where the resistivity dropped one order of magnitude (from 1.1x10-3 to 5.21x10-4 Ω cm) for an optimal O2 and H2 dilution of 1.46, followed by an increase of the AVT from approximately 30% to more than 83%. We observed that the improvement in the conductivity came essentially from the improvement of mobility that reached 46 cm2 V-1 s-1 for a carrier concentration of 2.63x1020 cm-3.

On the other hand, H2 can be used as post-treatment, for instance in In-based thin films prepared by spray pyrolysis as In2O3-Mo (IMO) or IZO. In sprayed IMO thin films with a post-annealed in an H2 step was possible to slightly improve the optical transmittance (AVT ≈ 82%) with an abrupt decreasing of nearly two orders of magnitude in the resistivity reaching values in the order of 10-3 Ω cm.