International Conference on

LASERS, OPTICS AND PHOTONICS

July 25-26, 2018 | Osaka, Japan

Transparent and conductive materials for opto-electronic applications

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There has been lately numerous researches devoted to nanostructured transparent electrodes, which play a pivotal role in many modern opto-electronics devices such as solar cells or light-emitting devices. Currently ITO (Tin-doped Indium oxide), the most commonly used material, suffers from two major drawbacks: indium scarcity and brittleness. This contribution aims at briefly reviewing the main properties of transparent electrodes (TE) as well as the challenges which we still face in terms of efficient integration in devices for several technologies. A more specific focus will be devoted to two promising TE. First the emerging transparent electrodes based on silver nanowire (AgNW) networks, which appear as a promising substitute to ITO with excellent optical and electrical properties fulfilling the requirements for many applications including flexible devices. In addition, the fabrication of these electrodes involves low-temperature processing steps and upscaling methods, thus making them very appropriate for future use as TE for flexible devices. Their main properties, the influence of post treatments or the network density and nanowire size but as well their stability will be discussed. The second studied TCM is based on Fluor-doped Tin Oxide (FTO) which exhibits interesting opto-electronic properties. We will show that a rather promising TE can be fabricated from S:TiO2-FTO nanocomposites which shows tuneable high haze factors from almost zero to 60% by using a simple and cost effective method. The resulting optoelectronic properties of such TE appear very well suited for its efficient integration into solar cells.

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