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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.

Biography

Bellet Daniel is an Assistant-Professor at Grenoble University in 1990 and is Professor at Grenoble INP since 1998. He was Junior Member at IUF (French institution to promote excellence in research) in 1999 and is now the Director of the Academic Research Community "Energies" at the Région Rhône-Alpes since 2011. His research is focused on material physics and more specifically now on transparent conductive materials. His works are two-fold aims: fundamental as well as integration of transparent electrodes in devices. He has co-authored more than 120 peer-reviewed publications or proceedings, 8 book chapters and has 28 as h-index.

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