**Brief overview of metallic nanowire based transparent conductive materials**

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Transparent electrodes (TE) play a pivotal role within numerous devices in optoelectronic or energy areas. This concerns for instance devices such as solar cells, light-emitting devices, touch screens, transparent heaters, low-emissivity films or smart windows. TE should exhibit high optical transmittance and low sheet resistance, as the two prevailing properties. However other characteristics appear also significant depending on applications; this concerns for instance optical haziness or mechanical flexibility. Transparent conductive oxides (TCO) have been studied for several decades, and are the most commonly used TE in industrial devices. Among them, indium tin oxide (ITO) films are the most common TE materials used by industry due to their good optical and electrical properties, while aluminum doped Zn oxide (AZO) or fluor-doped tin oxide (FTO) exhibit also good potential. TCO have been deeply investigated and optimized, however TCO are brittle and could be expensive. The development of next generations of optoelectronic devices needs TE that exhibit good optical and electrical properties, good flexibility and moreover their fabrication has to be compatible with high-throughput fabrication for industrial applications (roll-to-roll for instance) and low cost. Several emerging TE have been investigated with this aim: this includes carbon nanomaterials, conductive polymers and metallic nanostructures.[1,2]

Among the latter, metallic nanowire (MNW) networks have received intensive research interest thanks to their high electrical conductivity, optical transparency in visible and near infrared regions and excellent flexibility performances[3,4]. Such TE consist of a network of randomly oriented and interconnected MNW (so far mainly silver nanowires) deposited on a transparent substrate. While such TE exhibit very good electrical and optical properties, morphological instabilities induced by thermal or electrical stress and high surface roughness constitute the main bottlenecks for further long-term operating performance[5]. Metal oxide layers are shown as a promising protective overcoat around nanowires with encouraging results in terms of stability enhancement as well as flatness improving capability as compared to bare nanowires[6]. The nature of the metal oxides (such as SnO2, Al2O3, TiO2 and ZnO…) and how they affect concrete device performance is an aspect to be investigated for each application in order to tune and design more efficient device structures[6]. Main research works have dealt with the influence of MNW chemical nature and dimensions, network density, post-deposition treatment on the main properties of MNW networks. As the investigation of MNW based nanocomposites that can exhibit enhanced properties and/or stability has also been the subject of many studies[7].

The aim of this presentation is to give an overview of the main features related to MNW networks intensive research activities, including both fundamental and applicative aspects. The associated assets and drawbacks of MNW networks, as well as the challenges and opportunities, will be presented and discussed.

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