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Micro-texturing TiN and Ag Coating for Flexible and Transparent Electronics

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Abstract (300 word limit)

Since a few years, the semiconductor industry is looking for answering to the growing de- mand for new electronic devices with the ability to be (inter-) connected for sharing infor- mations with people and other devices within the framework of the so-called Internet of Everything (IoE). This demand will explode in the next few years, and will require the deve- lopment of new materials and technologies that are lighter, flexible, low-power and that can be integrated in wearable devices, sensors, displays and actuators [1,2]. Polymer substrates, were recently proposed as a potential candidates for light-weight, flexible and greener electronic devices [3,4]. Here we studied the fabrication of conductive nanocellulose (nanopaper) substrates for flexible solar cell and electronic devices applications. Sputtered titanium nitride (TiN) were deposited onto nanopaper substrates using radio frequency capacitively coupled plasma (RFCCP). Their electrical and optical properties were scrutinized as a function of substrate synthesis and TiN deposition parameters. Micro-texturing of the TiN coating is proposed for optimizing their electro-optical properties. The electrical and optical TiN properties were compared with commercially available PET/ITO substrates and Ag Nanowires (NWs) coatings already proposed as electrodes for nanopaper-based electronics[3,5]. Moreover, the conductivities of ITO, Ag NWs and TiN electrodes were scrutinized under repetitive mechanical stress, using a bending machine.

Image

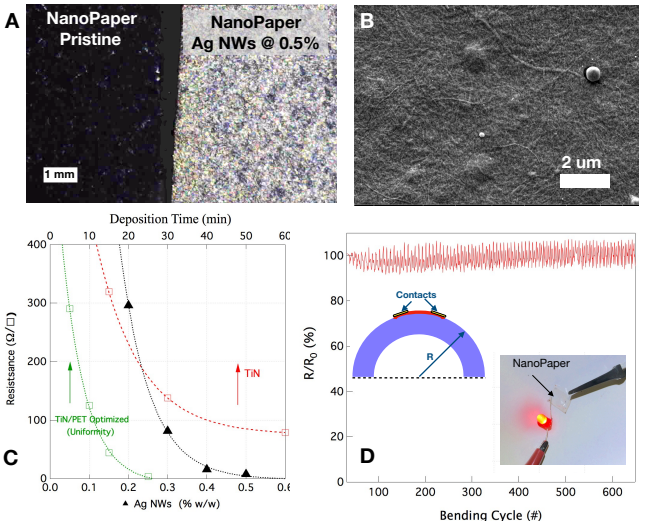


Fig. 1: Optical View Of (A) Nanopaper Substrate Before And After The Deposition Of Ag Nws. B) Sem Image Of A Tin Coating Sputtered Onto Nanopaper. (C) Square Resistance Of NanoPaper and PET Substrates as Function of Ag NWs Density and TiN Deposition Time. (D) Square Resistance Of A TiN Coated Nanopaper after 650 mechanical bending. The inset show the bending principle.

Key words:, Flexible Substrates, TiN, Nanocelulose, Electrodes, Devices, Organic Electronics, Polymer Solar Cells, Titanium Nitride, Nanowires, Mechanical, Bending

Recent Publications (minimum 5)

1. International Technology Roadmap for Semiconductors Edition 2.0 (2015)
2. H. Zhu *et al.* (2016) Wood-Derived Materials for Green Electronics, Biological Devices, and Energy Applications Chem. Rev. 116, 9305−9374
3. M. Nogi *et al.* (2015) Transparent Conductive Nanofiber Paper for Foldable Solar Cells. Scientific Reports 5, 17254
4. U. Celano *et al.* (2016) All-nanocellulose nonvolatile resistive memory. NPG Asia Materials 8, e310.
5. C.-L. K. *et al.* (2017) A highly flexible transparent conductive electrode based on nanomaterials. NPG Asia Materials 9, e438.

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