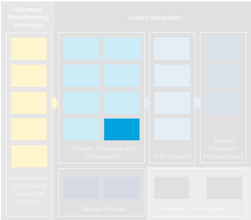

PATHFINDER 2015

SYSTEM INTEGRATION

Spray coated nanowires; enhanced stability for touch sensing and solar cell applications (Stable Nanowires)

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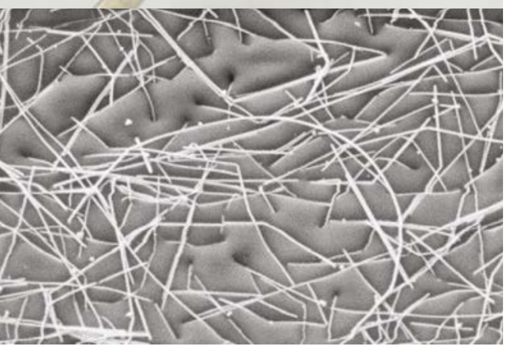
Metallic nanowires with well-defined dimensions are a promising transparent conducting material for electrical and optical devices, particularly as flexible and conformal transparent electrodes, and are a strong candidate for ITO substitution. They combine several advantages such as high optical transparency, low sheet resistance and mechanical flexibility. These properties make them a candidate for applications like flexible and large area sensors and detectors, touch screens, flat panel displays, OLEDs and organic solar cells and layers for heated windows. However, their application to such devices, is challenging due to a highly non-uniform surface topography, which can cause shorting through thin interlayers and between electrodes. In addition, other challenges exist such as long-term environmental stability, contact resistance between electrode and active materials, which must be overcome to fully integrate these new electrodes into commercial devices.



This project is addressing many of these challenges by developing new manufacturing approaches that enable enhanced conductivity and improved long-term environmental and electrical stability. Fundamental to this is the continued development of an approach developed at Bangor University, which enables AgNWs to be deposited onto a flexible substrate with low surface roughness and high electrical/optical performance. Through the 'Stable-Nanowires' project, we have recently demonstrated sheet resistance, R_{SH}=8Ω/sq and transparency of 88% in the visible-SWIR spectrum (300-2500nm) onto PET substrates. To our knowledge, this is one of the best performances demonstrated for any transparent electrode materials commonly mentioned as an ITO replacement. An added advantage of the technique developed is that planarised layer (average surface roughness, R_A, <8nm) is developed after processing, which significantly widens the future possible applications of metallic NWs and ensures that the AgNWs developed could be readily integrated into many process chains. During the project, we have shown that the electrodes can be integrated into functional organic and perovskite solar cells. Further work is ongoing to quantify the stability to high bias conditions relative to ITO technology. Enhanced bias stability is demonstrated by reducing the contact resistance and by material purification.