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## **Surface defects in water vapour barrier layers for structured plastic electronics**

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This paper reports on the progress of the NanoCleaR project, which began in January of 2012. With funding awarded by the EU's Seventh Framework programme, this project seeks to develop integrated process inspection, cleaning, repair and control systems for nano-scale thin films on large area substrates.

The outcomes of NanoCleaR will benefit the many areas of active research involved in the manufacture of devices on large area plastic films. For example; flexible photovoltaics, lighting and display devices. These flexible devices are fabricated on polymer film by the repeated deposition, and patterning, of thin layer materials using roll-to-roll processes.

The surface of the starting polymer film must be of very high quality in order to avoid creating defects in the device layers. Since these defects reduce manufacturing yield, in order to prevent them, a thin, flexible coating is generally applied to the polymer film prior to structuring.

NanoCleaR is studying the ultra-thin aluminium oxide layers on the polymer film, which are designed as barrier layers for structured flexible photovoltaic modules. Barrier films are required to prevent the ingress of water vapour and oxygen from degrading the efficiency of solar energy conversion. Highly conformal aluminium oxide barrier layers have been produced by atomic layer deposition on plastic films with smooth surface coatings.

This paper begins by reporting the results of early stage measurements conducted to characterise the uncoated and coated polymer film surface topography using feature analysis. This paper will then describe how surface irregularities on the film can create defects within the nanometre-scale, aluminium oxide, barrier layer.

The need for improved, high speed, surface inspection for the quality control of large area flexible electronics manufacturing, is then discussed and illustrated for several stages of the manufacture of surface structured flexible electronics. The paper concludes by trying to understand the implications of the results for in-process defect detection in R2R manufacture.