Micro- and nano-scale defect detection, cleaning and repair techniques to improve the quality of nanoscale barrier coatings

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NanoMend is a collaborative FP7 project investigating micro- and nano-scale defect detection, cleaning and repair techniques for large area substrates. It is set up by 14 leading European companies and research centres. The project aims to develop technologies that are able to detect and repair defects within thin films, without reducing production efficiency. NanoMend will demonstrate the new technologies for two industrial applications; flexible photovoltaics and coated fibre-based packaging products.

Thin films can be deposited on a range of large area substrates, including food packaging materials and flexible solar panels. Defects within these films can reduce yield, longevity and performance of the materials. Through developing the means of detecting these defects, NanoMend aims to improve the performance of these products and, at the same time, reduce the manufacturing costs associated with the production of scrap. Defects can occur at different stages in the manufacturing process and can be caused by anomalies, such as contamination and thickness variations of the film. Micro- and nano-scale defects in barrier films enable water vapour to pass through the material, which significantly reduces the properties and applicability of the material.

The high resolution, cost-effective, micro and nanoscale detection and directional cleaning technologies being developed by NanoMend will help improve the performance, and drive down manufacturing costs of, a range of products. The outcomes of NanoMend will benefit many world class companies in Europe, who are manufacturing high volume products using thin films on large area substrates. These companies serve established markets, such as paper and packaging as well as emerging markets such as printed electronics.

Atomic layer deposition (ALD) is a technique producing conformal thin films of materials onto a substrate. With ALD, especially water vapour and oxygen barrier properties of materials can be improved. For example, BOPP films are good barriers against water vapour, but they only moderately prevent the transportation of permanent gases such as oxygen and nitrogen. In order to block these permanent gases, BOPP films are typically coated with a thin metal oxide layer produced in a physical or chemical vapour deposition process. A barrier layer with thickness in the nanometre range is able to considerably improve the oxygen barrier of BOPP films [1]. In this project, recently developed roll-to-roll ALD technology is used to improve the barrier properties of BOPP.

References: [1] K. Lahtinen, J. Lahti, P. Johansson, T. Seppänen, DC. Cameron, “Influence of substrate contamination, web handling, and pretreatments on the barrier performance of aluminum oxide atomic layer-deposited BOPP film”, J. Coat. Technol. 2014, Res. Doi: 10.1007/s11998-014-9584-9.