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## In-line Surface Metrology for Roll to Roll Manufacture of Thin Film Barrier

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The growing market for large-area printed electronics and flexible solar cells in particular have stimulated the development of commercial Roll to Roll manufacture of nano-scale AlOx thin film barriers to limits the impact of environmental degradation. Increasing the yield of Roll to Roll ALD manufactured thin film barriers faces a major challenge of developing in-line detection of micro/nano-scale defects on film surfaces. These defects have been shown to have negative impact on the performance of the barriers resulting in reduced efficiency and lifespan of the coated PV modules. This paper introduces wavelength scanning interferometer (WSI) system developed as part of the EU funded NanoMend project. The system comprises a full in-line opto-mechanical solution for defect detection in 40nm thick Atomic Layer Deposition, ALD, coated environmental barrier films used for photovoltaic (PV) solar modules. The WSI has a 6nm vertical resolution and is embedded within a Roll to Roll film-rewinder stage and integrated with the substrate translation and kinematic stages. The system additionally has an auto-focus ability to adjust the focal plane on the top surface of the film with an accuracy and repeatability better than 6 μm at optimum optical alignment conditions. As a result, the metrology system allows surface measurement over full substrate widths of approximately 0.5m and the consequent measurement time required for each area of captured data is less than 1 sec. To ameliorate external vibrations the measurement solution combines a dual path interferometer and a non-contact film holding capability. The Roll to Roll inspection process and measurement results provide evidence for further development of in-line/in-process metrology systems that can be used on a shop floor.

### Biography:

Dr Hussam Muhamedsalih is a research fellow in the EPSRC Centre for Innovative Manufacturing in Advanced Metrology at the University of Huddersfield. Hussam initially joined the University of Huddersfield to study for an MSc in Control Systems and Instrumentation, graduated in 2008. Continuing his studies at Huddersfield, Hussam was awarded a PhD on May 2013 for the project 'Investigation of wavelength scanning interferometry for embedded metrology'. The aim of his research is to break new ground by delivering solutions in advanced metrology for the next generation of high added-value products to assist industry achieving the paradigm shift toward smart factories.