Verification of an in Process Optical System based on High Resolution Interferometry for Detecting Flexible PV Barrier Films Defects

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Abstract

The relationship between surface morphology, defects density and water vapor permeability of aluminium oxide (Al_2O_3) barrier coating on polyethylene naphthalate (PEN) films, used particularly to prevent water vapor and/or oxygen ingress into flexible photovoltaic (PV) modules has to date been studied in the laboratory. However; detecting defects off-line for flexible PVs is difficult and time consuming, and as such devices are manufactured by R2R methods this procedure can often result in large quantities of barrier films being manufactured before defects are detected. In addition, the quality requirements and line speed are continuously increasing and off-line methods are not efficient to operate within these requirements. Hence, it is desirable to make use of non-contact optical based in-line inspection systems during PV manufacturing processes. Nevertheless, implementing highly accurate in-line (optical) measurement system in the PV production environment can be challenging, as the requirements on positioning and stability are demanding. This research paper reports on the deployment of new in-line interferometric optical technique based on wavelength scanning interferometry (WSI), for detecting PV barriers defects. The instrument has built-in environmental vibration compensation, providing areal measurement at high speed of less than a second per field of view. The technique is being deployed on a demonstrator system at a Roll2Roll production facility as shown in Figure 1. The results show the capability of the WSI to be used as a quality assurance tool in PV production lines, where the results compare favourably with off-line metrology techniques.

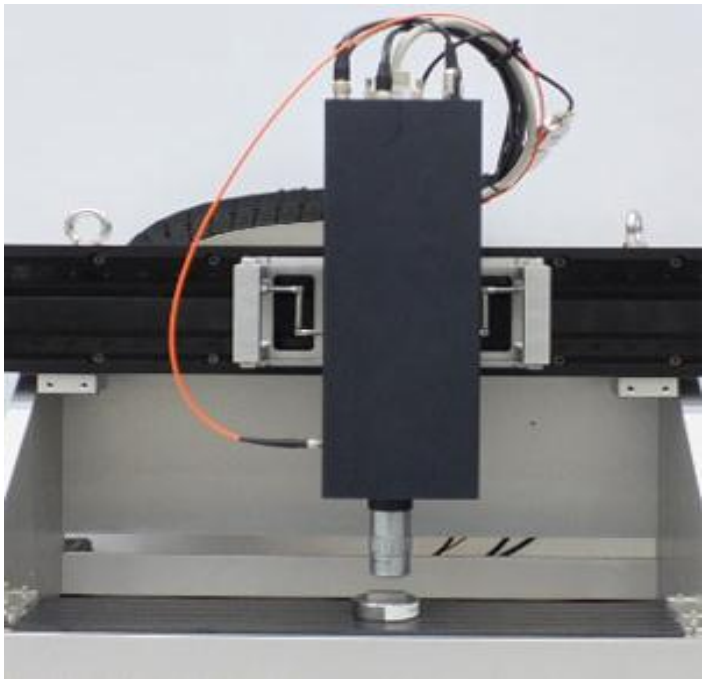

Figure 1: WSI deployed in R2R facility