# Towards inline real-time characterization

Scientific paper, published 2023

- Towards in-line real-time characterization of roll-to-roll produced ZTO/Ag/ITO thin films by hyperspectral imaging

# Towards in-line real-time characterization of roll-to-roll produced ZTO/Ag/ITO thin films by hyperspectral imaging

Please view the full paper via https://doi.org/10.1088/1361-6463/acd8c9 (open access)

Large area manufacturing processes of thin films such as large-area vacuum roll-to-roll coating of dielectric and gas permeation barrier layers in industry require a precise control of e.g. film thickness, homogeneity, chemical compositions, crystallinity and surface roughness. In order to determine these properties in real time, hyperspectral imaging is a novel, cost-efficient, and fast tool as in-line technology for large-area quality control. We demonstrate the application of hyperspectral imaging to characterize the thickness of thin films of the multilayer system ZTO/Ag/ITO produced by roll-to-roll magnetron sputtering on 220 mm wide polyethylene terephthalate substrate. X-ray reflectivity measurements are used to determine the thickness gradients of roll-to-roll produced foils with sub nanometer accuracy that serve as ground truth data to train a machine learning model for the interpretation of the hyperspectral imaging spectra. Based on the model, the sub-layer thicknesses on the complete substrate foil area were predicted which demonstrates the capabilities of this approach for large-scale in-line real-time quality control for industrial applications.