

# Verification of in-situ observation of perovskite layer curing and quenching and surface imaging on $> 20 \times 20 \text{ cm}^2$ on moving substrate (0.5 m/min)

Please find the full text in the attachment.

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This deliverable describes the validation and demonstration of hyperspectral imaging (HSI) and x-ray diffraction (XRD) analytical tools for process and quality control in perovskite solar cell manufacturing. The XRD and HSI hardware and software are used to evaluate characteristic properties of perovskite coatings, such as thickness, roughness and phase composition. Partial least square regression (PLS) quantification models are developed to correlate the in-line HSI signals with the film properties.

Perovskite films are deposited on 30 cm x 40 cm glass substrates by slot die coating of the precursors ink, followed by vacuum quenching and thermal annealing in a semi-automated pilot line. Hyperspectral images are recorded during the film quenching and after a complete curing cycle (quenching and subsequent annealing). XRD spectra are measured after complete curing of the samples on several points of the sample. Thickness and roughness are measured by means of off-line techniques.

By incorporating the perovskite layers characterized with the NanoQI tools in a complete p-i-n device architecture, semitransparent solar cells were fabricated and their photovoltaic parameters were determined with a solar simulator at standard testing conditions.

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