

InspiRe – LayTec’s new in-situ monitoring tool for perovskites

Recently, the efficiency of perovskites photovoltaics (PV) has increased tremendously [1]. In a tandem configuration at Helmholtz-Centre Berlin (HZB), even the best silicon solar cell was surpassed (29.1%) using wet-chemical low-cost methods [1, 2]. Despite this progress many challenges remain for this technology. LayTec’s new **InspiRe** (Fig. 1) in-situ metrology system applies high-speed in-situ reflectance measurements for monitoring perovskite thin film formations during spin-coating and subsequent annealing.

annealing indicate “over-annealing” after the desired band gap has been achieved. This methodology, for the first time, allows to systematically study film formation during two crucial process steps for identifying optimization routes and for implementing a rigid quality control scheme for up-scaling and industrialization. In an upcoming publication, the HZB researchers will present their analysis of the perovskite formation based on measurements employing LayTec’s **InspiRe** metrology system.

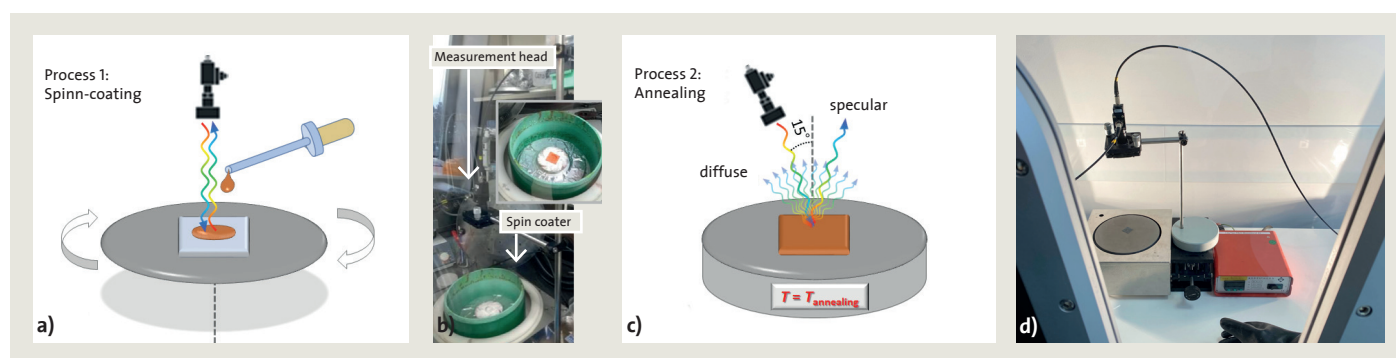


Fig. 1: Experimental setup for spin-coating (a, b) and annealing (c, d) of perovskite thin films illustrating the concept of the particular measurements (a, c) and the actual setups (b, d). LayTec’s InspiRe metrology system was employed for monitoring both key processes for perovskite thin film formation.

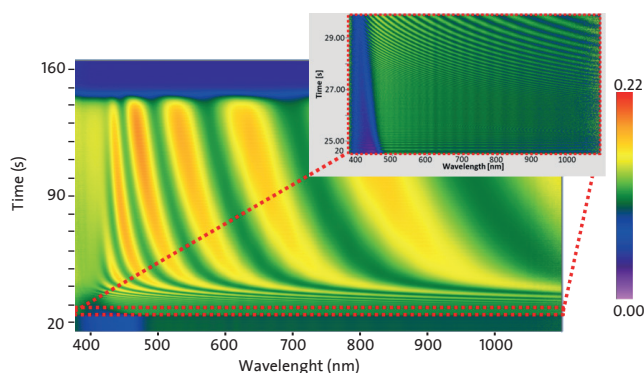


Fig. 2: Spin-Coating: Exemplary color plot obtained during perovskite deposition. The inset zooms into the first 5 s after starting the rotation.

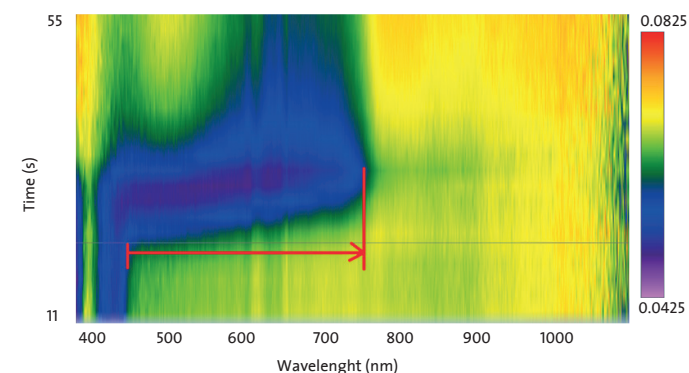


Fig.3: Annealing: Example of a color plot obtained during perovskite annealing. The red arrow marks the shift of the absorption edge.

In collaboration with Prof. Dr. Norbert Nickel’s group at HZB, LayTec designed the **InspiRe** in-situ metrology system, which was applied to monitor both, spin-coating (Fig. 2) and annealing (Fig. 3). Gathering data at a time resolution on the millisecond scale allows to resolve the kinetics and phase formations during film formation.

While spin-coating the absorption behavior and the thinning of precursor solution is monitored. The absorption edge, i.e. band gap, of the deposited perovskite film is directly derived during annealing. Spectral changes during

[1] [National Renewable Energy lab, January 2020](#)

[2] [Helmholtz-Centre Berlin, “World Record: Efficiency of perovskite silicon tandem solar cell jumps to 29.15 percent”, January 2020](#)

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