

Perovskite Solar Cells: The Reality Check

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Perovskite solar cells (PSCs), based on metal halide perovskites (MHPs), have emerged as a promising revolutionary photovoltaic technology due to their exceptional optoelectronic properties and rapid efficiency improvements. However, big challenges quickly emerged, such as long-term stability and scalability. Those problems remain to be the key obstacles to commercialization even 10 years after their discovery.

During my Erasmus+ internship at the University of Twente, we explored the scalability challenges by investigating the impact of steeply increasing deposition rate in vapor deposition methods. Using pulsed laser deposition, we fabricated MHP thin films with deposition rates ranging from 6 nm/min to 80 nm/min. To gain deeper insight into the deposition process, we developed and implemented an in-situ photoluminescence (PL) setup to track PL signal evolution directly during thin film formation. Surprisingly, the PL evolution remained consistent across this wide range of deposition rates, suggesting that the fundamental perovskite formation mechanisms remain largely unaffected by deposition rate, even though film quality is reduced at higher rates. Additionally, we identified the growth stages where most defects are created.

