Thin films as model systems in Materials Science for renewable energy applications

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With pulsed laser deposition we can manipulate the crystalline and morphological properties of materials, engineer surfaces and interfaces with specific functionalities, and fabricate model systems to characterize physicochemical properties that are difficult or impossible to probe with bulk samples.
In this presentation, I will discuss two examples where thin films are applied to Materials Science for renewable energy conversion and energy storage.
The first example concerns (is on) the growth of thin films of oxynitride semiconductors used for hydrogen generation by solar water splitting. We use (*operando*) X-ray absorption spectroscopy and neutron reflectometry to characterize the evolution of the solid-liquid interface under a unique and novel perspective.
The second example demonstrates the effect lattice distortions (strain) have on electrical properties of solid-state oxygen-ion and proton conducting oxides. These ionic conductors are mainly used as electrolytes for solid oxide fuel/electrolyzer cells. We will show how stress of the conductor can be monitored *in situ* during growth and how strain modifies the potential barrier for the ionic migration in solids.
These two studies highlight the potentials of thin films as model systems for fundamental studies.