Optical characterization of perovskite materials using Spectroscopic Ellipsometry

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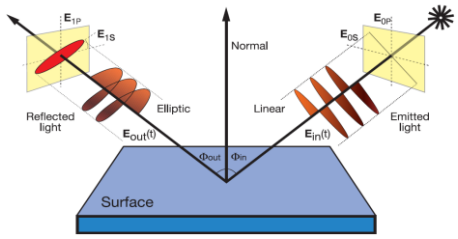
Hybrid organic-inorganic perovskite materials have emerged over the past five years as absorber layers for new high-efficiency yet low-cost solar cells that combine the advantages of organic and inorganic semiconductors. In despite this significance evolution, the physics behind the electronic transport in these materials is still poorly understood.

A suitable technique for characterizing thin films of perovskites is spectroscopic ellipsometry, which is a surface sensitive, non-destructive, non-intrusive optical technique that measures the change in the polarization state of light reflected from the surface of a sample.

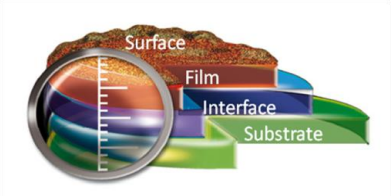
It provides significant advantages for nano-material characterization such as determination of film thickness with Ångstrom resolution and determination of optical constants that allow the deduction of a wide range of physical properties.

We performed ellipsometry measurements (together with Tauc-Lorentz modeling) in order to validate the dielectric properties obtained in the visible spectrum (high-frequency regime).

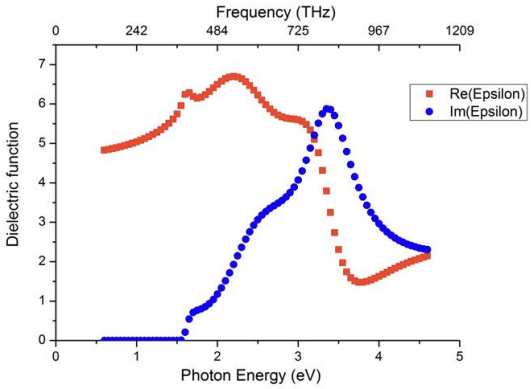
The analyzed samples consist of the first four layers of a fully constituted “inverted” PSC: glass, ITO, PEDOT: PSS and MAPbI3 which are made and maintained in a nitrogen environment during the entire measurement process.



Change the polarization state of the light reflected



Main properties determined by Spectroscopic Ellipsometry



Dielectric function of cubic MAPbI obtained by ellipsometry