Active Control of Interfaces in Thin Film Solar Cells for Performance and Stabilization

Ina T. Martin
Co-authors : Kyle M. Crowley, Mirra M. Rasmussin
Case Western Reserve University, Cleveland, OH, USA

Abstract

Global energy demand requires the development of efficient and reliable thin film photovoltaics with inexpensive processing. As the efficiency of hybrid perovskite solar cells has skyrocketed, practical constraints of the technology have put the scalability and durability into scientific focus. The development of inorganic interfacial layers, such as metal oxides, is a potential pathway to overcoming the stability and cost limitations associated with organic interlayers in perovskite solar cells. Thin films are sensitive to both the growth conditions, and the composition and morphology of the previously deposited layer. Interfacial engineering of metal oxides using molecular modifiers provides a powerful tool to tune interlayer properties, which can result in improved performance and stability.

Spectroscopic ellipsometry is an invaluable tool for rapid, sensitive, non-destructive characterization of materials and interfaces at every step of growth. It is particularly well suited to characterizing the deposition of nm and sub-nm layers of molecular modifiers, including organofunctional silanes. Our results show that the nature of the silane layer has a profound effect on the properties of the subsequent perovskite film. This work is broadly applicable to other oxides, including but not limited to transparent conductive oxides used as window layers, and modification of glass for applications such as biomicroarrays.