ALD of Al2O3 on Perovskite Solar Cells: Role of Active Interfacial Engineering

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Atomic Layer Deposition of ultrathin Al_2O_3 on hybrid perovskite solar cells drew significant attention due to the considerable improvement in the overall device stability. In our laboratory, with intermittent current-voltage measurements, the coated devices show the value of T80>7500 hours under ambient conditions. Subsequently, these coated devices are found highly stable when measured in a cyclic manner for 7 days, replicating the real-life day-night sequences. Such *encapsulation* is found very effective as an oxygen barrier-layer and water-impermeable membrane; hence contribute to the overall stability of these devices.

In this presentation, I would like to emphasize on our experimental findings, subsequently supported by device simulation, which undoubtedly reveals that the perovskite-spiroOMeTAD interfacial band-structure play a detrimental role in initiating the degradation processes in the pristine devices (device structure). We try to provide a comprehensive insight depicting an apparently non-trivial active phenomenon resulted due to the ALD grown Al_2O_3 layer that supposedly be a passive component of the entire device stack. Favored electronic modification of the spiro-OMeTAD/perovskite interface resulted due to the Al_2O_3 ALD provides better charge extraction and lesser ionic accumulation, unlike the unencapsulated devices, and hence offers better performance stability. Our study indicates that essentially the ionic accumulation triggers the device degradation that is eventually followed by materials degradation.