The Effects of Solvent on Thin Film Coatings for Perovskite-Oxided-Based Solar Cell

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Overview

- Perovskite solar cells (PSC) are an emerging type of photovoltaic cell, with reported device stability over 1000 hours and efficiencies of 12.8% [1].
- Inkjet printing the mesoporous thin films of methylammonium lead halide PSC would allow for mass production of the technology.
- For inkjet printing, it is important to determine which solvent/powder combination produces the most homogeneous thin film coating.

Results: Visual Images of Pastes

- Terpineol and DMF solvent slurries resulted in the most uniform thin films for TiO$_2$ and ZrO$_2$ nanopowders.
- Isopropanol slurries resulted in flaking thin films and proved difficult to apply.
- Carbon particles exhibited heterogeneous suspension in both the DMF and isopropanol solvents.
- The carbon with terpineol film looks the most homogeneous in images, but did not adhere to the glass.

Methodology for Perovskite Solar Cell Fabrication

- FTO glass is etched using Zn flakes and 2M HCl.
- ALD is used to deposit a layer of compact TiO$_2$.
- TiO$_2$, ZrO$_2$, and C powders are mixed with solvents to create slurries.
- Mesoporous TiO$_2$, ZrO$_2$, and C pastes are deposited using a doctor-blade technique and annealed at temperatures between 450 – 550 °C.
- MAPbI$_3$ perovskite is deposited via drop-casting in inert atmosphere.

Results: XRD for Confirmation of TiO$_2$ Formation

- X-ray Diffraction (XRD) was used to confirm annealing of TiO$_2$ paste.
- Anatase structure (A) is present in the resulting TiO$_2$ film.

Continuing Work

- Reduce paste viscosities to match commercial ink viscosities.
- Application of Kapton tape as the masking material during ALD of compact TiO$_2$.
- Create and drop-cast perovskite crystal onto mesoporous thin films in inert environment.
- XRD of ZrO$_2$ and C thin films, as well as completed PSC.
- Incorporation of inkjet printer instead of doctor blading for paste deposition.

References