Modeling Solid State Electrolytes for Dye Sensitized Solar Cells
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Problem to Address
- Liquid electrolytes tend leak over time and can degrade electrodes, decreasing the efficiency of the cell.
- A reproducible, simpler method of forming the portion of the cell with electrolyte and photocatalyst is needed.
- Current dispersion of nanoparticles in film is about 64 volume percent of the constituent particle in solution.

Applications
- This modeling process can be used in DSSCs to improve the durability and long-term efficiency of the solar cell.
- The capillary infiltration method to be used.

Method/Procedure
- Modeled solid state electrolyte with polystyrene (PS), since properties are similar.
- Used spin and dip coating to form thin films of various thicknesses.
- Prepared solutions by mixture in vortex mixer and sonicator to disperse nanoparticles effectively.
- For spin coating, solution was deposited onto silicon substrate, then shear forces spread solution evenly over a programmed time interval.
- For dip coating, goniometer lowers substrate into solution and then extracts at programmed speed, with a film forming by nanoparticle adhesion to substrate.

Motivation: Fixing the Leaks

Problem/Address
- Current dispersion of nanoparticles in film is about 64 volume percent of the constituent particle in solution.
- Films were rough and uneven in most cases.
- Mixture solutions were viscous above 15 w/v% PS.

Applications
- This modeling process can be used in DSSCs to improve the durability and long-term efficiency of the solar cell.
- The capillary infiltration method to be used.

Future Work
- Determine a method of adhering polystyrene to silica substrates without changing its physical properties.
- Determine the refractive index of 25 nanometer polystyrene nanoparticles using liquid cell ellipsometry coupled with equations noted previously.
- Perform alternate treatments to polystyrene and titania mixture solutions (alter concentrations, pH, charge, addition of surfactants potentially) in an attempt to successfully form mixture films.
- Perform capillary infiltration to vary volume percent of titanium dioxide (photocatalyst) versus electrolyte in DSSCs.