2019 MRS FALL MEETING & EXHIBIT
December 1–6, 2019 | Boston, Massachusetts

Dye-Sensitized Solar Cells Based on Tin and Zinc Oxide Composite Films Using Ionic Electrolytes

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After decades of research, long term stability of dye sensitized solar cells (DSCs) continue to remain a questionable issue. The observed instability is caused by dye and electrolytic degradation and gradual evaporative elimination of the volatile component of the electrolyte via unavoidable faults in the sealing. Degradation of the dye and the electrolyte is mainly due to photocatalytic reactions mediated by titanium dioxide. Of familiar high-band gap oxide materials, short wavelength (< 300 nm) radiation initiated by photo-catalytic activity originating free radical generated by hole transfer to water molecules is strongest in titanium dioxide. Although DSCs made from less photo- catalytically active tin and zinc oxides are inefficient, composite tin-zinc oxide films yield efficiencies comparable to those fabricated out of titanium dioxide films. Studies conducted reveal that DSCs based tin-zinc oxide films are highly stable when moisture free high boiling point solvents are incorporated to solubilize the conventional iodide/tri-iodide redox system. Sensitized charge injection and transport in composite tin-zinc oxide films and the possible causes of enhanced stability will be discussed.