Isn’t It Ionic: Reducing Toxicity in Perovskite Precursors

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Abstract

As energy production is increasingly diversified and tailored to region and requirement, heavy interest is in photovoltaics. Part of the growing network of sustainable energy production should predictably be large scale solar harvesting, either for the grid or for off grid direct supply. However, the current marketable solar cells require a large amount of silicon purification, a resource already being heavily relied upon. There are many options for alternative active layers, but perovskite has been rapidly and competitively improving since the first use as a sensitizer. A key aspect of these cells is their solution processability, which should mean continuous printing process compatibility such as roll-to-roll slot-die coating. However, the widespread use of toxic solvents for cell synthesis could preclude them from large scale manufacturing. Less toxic solvents have been demonstrated for the Methylammonium Lead Iodide Perovskite (MAPbI) crystals, proving their viability for use in scaled-up, fully roll-to-roll coated devices. Considering the effects of polarity, hydrogen bonding and, fluctuation induced di-polarity (dispersive forces) on solubility, a fast way to adjust the solvent strength is to introduce an ionic compound into a less toxic solvent. The base solvent has a Workplace Exposure Limit (WEL) for long term working that is eight times higher (for parts per million) than the standard DMF. This study investigates the use of ionic solvents for the deposition of Formamidinium Lead Iodide (FAPbI), examining their impact on longevity and the resulting reduced toxicity in two-step deposition spin-coated devices.

Keywords

FAPbI, Ionic Liquid, Solvent, Perovskite