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Improving Mechanical and Environmental Stability of Perovskites with Polymer Additives

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ABSTRACT: Metal halide perovskites (MHPs) have tremendous promise as a low-cost, highly efficient photovoltaic technology; however, their potential is limited by the lack of stability. We have identified MHPs as the most mechanically fragile of any PV technology. In fact, the elastic properties, bonding, and fracture energy of MHPs are essentially comparable to salts such as NaCl. In this work, we demonstrate how starch-based polymer additives can be used to significantly improve the elastic and mechanical properties of MHPs by increasing deformability and modifying microstructure of the film. The large tensile film stresses that typically occur from MHP processing are also significantly reduced using the additives, a characteristic which enables improved environmental stability. Lastly, the additives enable one-step processing of reproducible MHP devices in open-air with scalable processing methods such as blade coating.

Short BIO:

Nick Rolston is an Assistant Professor in the School of Electrical, Computer, and Energy Engineering at Arizona State University and a Graduate Faculty in Materials Science and Chemical Engineering. He received his B.S. in Physics and Mathematics from the University of Iowa and his Ph.D. in Applied Physics from Stanford University for his work on the characterization, design, and fabrication of rapid open-air processed thin-film perovskite photovoltaic devices, after which he spent a year as a postdoctoral researcher in Materials Science and Engineering. His research group at ASU focuses on understanding fundamental mechanical and material properties in thin-film energy devices on length scales from angstroms to meters and developing scalable, open-air deposition methods to produce robust, low-cost solutions toward the goal of manufacturing the next generation of renewable energy technology.

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