

MATERIALS SCIENCE GRADUATE PROGRAM

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Cold Thoughts on Perovskite Fever

The latest progress in solution-processed organic-inorganic hybrid perovskites solar cells (PSCs) is reshaping the growth pattern of any prior photovoltaic technologies, as “trademarked” by their soaring power conversion efficiency over 25%. However, it also appears high time to inject an intense dose of cold thoughts into this globally-spreading “perovskite fever”, because PSCs are still facing a critical materials science triathlon challenge in stability, scalability and toxicity. Overcoming these hurdles requires a comprehensive basic science understanding of the excellence of hybrid perovskites in both charge transport and light harvesting so as to render crucial fundamental clues towards better photovoltaic materials and beyond. In this talk, I will show that a holistic mechanistic consideration in interface energy level alignment, work function and conductivity of materials can help to identify low-cost substituents for the costly gold electrode in PSCs for future scalability. Furthermore, I will present how ionic dopants and non-radioactive isotope-substituted components can stabilize the chemical stability of the resulting perovskites under various stress factors, and how the principle of electronegativity can mitigate the toxicity of lead leakage from PSCs subject to severe damage. I will also present our discovery of peculiar optoelectronic properties of perovskites by modulating their bond angles and bond lengths via high pressure method to understand the structure-property relationship in perovskites.



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