



# PHYSICS COLLOQUIUM: Stability of Perovskite Materials and Solar Cells

**Vikram Dalal**

Anston Marston Distinguished Professor of Engineering  
Iowa State University

**Date:**

10/7/2022

**Time:**

10:30 AM - 11:50 AM

**Location:**

KOLLIG 217

**About The Speaker:**

Vikram Dalal is Anson Marston Distinguished Professor of Engineering at Iowa State University. He obtained his B.S. degree in Electrical Engineering from University of Bombay in India, and Ph.D. in Electrical Engineering from Princeton University. He also holds a M.P.A. degree from Princeton, with major subject being Economics. He has been working on semiconductor research for over fifty years, and solar cell R&D for 49 years. He invented the basic tandem cell architecture for amorphous Si/amorphous Ge cells and amorphous Si/polycrystalline Si cells. He has concentrated on thin film solar cells including a-Si, nanocrystalline Si, crystalline Si, organic solar cells, CdSe cells, and over the last 8 years, perovskite solar cells. The work by his group led to the fundamental understanding of how ions affect the photo-stability of perovskite solar cells, and his work on all-inorganic perovskite cells has led to the development of stable perovskite cells. His work on CdSe solar cells has led to fundamental understanding of transport and defects in CdSe materials and devices.

**Abstract:**

Hybrid organic/inorganic perovskite solar cells have shown remarkable progress in their performance, increasing  $\eta$  from a few % efficiency to 25% in little over a decade in time. But there are several problems with perovskites that need to be solved before they can become a commercial technology for wide scale use. There are five fundamental degradation mechanisms that need to be addressed. These are:

- Thermal degradation
- Moisture-induced degradation
- Photo-induced degradation of the absorber material
- Photo-induced degradation of heterojunctions
- Degradation of contacts during photo-degradation

In this talk, I will address the physics of each of these phenomena, and show how one can reduce the overall degradation significantly, achieving a stable cell. The strategies include removing all organic materials from the perovskite, and from the heterojunction layers. The moisture induced degradation is minimized by using Br instead of I. I will also show how one can also get a very high voltage (1.7V) in an inorganic, Br containing perovskite device with inorganic heterojunction layers by using appropriate buffer layers at the heterojunctions.

For more information, contact : Sarah Kurtz  
skurtz@ucmerced.edu