Integrated Modeling (PV-4)

A joint India-U.S. research consortium funded under the *Joint Clean Energy Research & Development Center (JCERDC)*

Scientific Achievement:

(A) Characterized inversion charge in HIT cells using a multi-probe approach that involves I-V and C-V measurements. Illustrated that many features of dark I-V correlate well with C-V measurements.

(B) Developed a comprehensive modeling framework, well calibrated with experimental results from literature, to understand / interpret perovskite-based solar cells and suggest further optimization schemes.

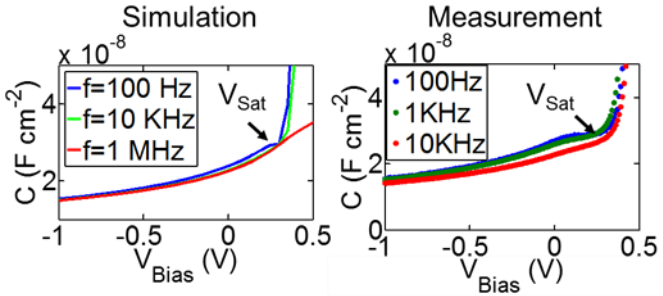
Significance and Impact:

Item (A) above could lead to a more detailed understanding of HIT cell device physics.

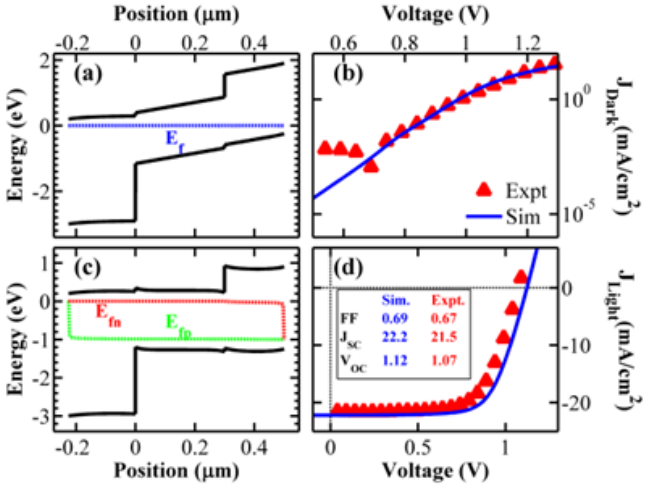
Item (B) above provides a baseline theory for perovskite-based solar cells and indicates how much the efficiency could be improved.

Research Details:

- Involves self-consistent simulation of Poisson and continuity equations.



C-V characteristics of HIT cells: simulation (left) and experiments (right).



Band structure and I-V of perovskite-based solar cells. (a), (c): Energy band diagram at dark and Voc conditions, respectively; (b), (d): Dark I-V and light I-V, respectively. Experimental data from *Nature*, 2014.

Publication(s):

[1] R. Chavali et al., "Correlated Non-Ideal Effects of Dark and Light I-V Characteristics in a-Si/c-Si Heterojunction Solar Cells," IEEE J. Photovoltaics, 2014.

[2] N. Chatterji et al.,"A Critical Analysis on the Role of Back-Surface Passivation for a-Si/c-Si Heterojunction Solar Cells," 40th IEEE PVSC.

[3] S. Agarwal et al., "Performance Optimization for Perovskite based Solar Cells," 40th IEEE PVSC.

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