

Inroads into Si-Heterojunction Device Physics



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

Scientific Achievement:

- Proposed a new characterization technique—modulated electroluminescence (MEL)—for determining lifetime of solar cells.
- Developed a diagnostic tool using dark current-voltage (I-V) measurements.

Significance and Impact:

- MEL is a simple and convenient technique for extracting the minority-carrier lifetime, an important metric for solar cells.
- Analysis of dark I-V characteristics using the tool provides deep insights into the non-idealities in carrier transport that affect solar cell efficiency.

Collaborations:

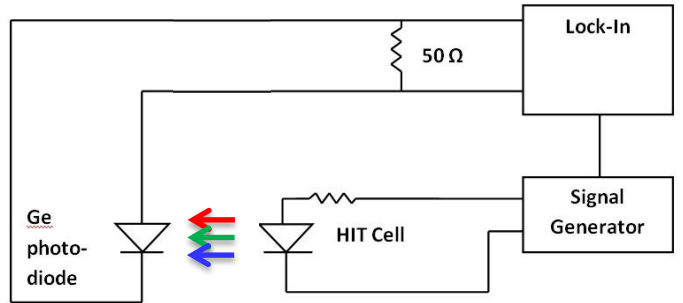
- This effort is an excellent collaboration between Moser Baer, Purdue University, and IIT Bombay, bringing together their respective strengths on industry-level fabrication, simulation, and electrical characterization.

Research Details:

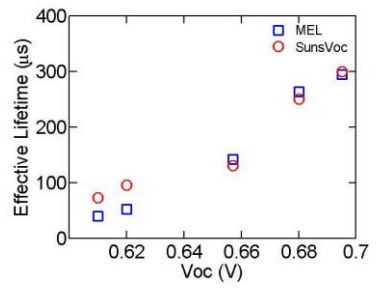
- Electroluminescence-based characterization of Si heterojunction cells done at IIT Bombay.
- Simulation studies on the same cells done at Purdue University.
- Si heterojunction cells provided by Moser Baer Photovoltaic Pvt. Ltd.

Publications:

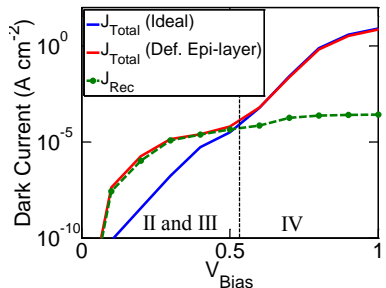
- Sanchit Khatavkar, M. Kulasekaran, Vijay Kumar, C.V. Kannan, Pradeep Nair, and B.M. Arora, Modulated Electroluminescence Technique for Determination of the Minority Carrier Lifetime of Solar Cells, 39th IEEE PVSC, 2013.
- Raghu V.K. Chavali, John R. Wilcox, Biswajit Ray, Jeffery L. Gray, and Muhammad A. Alam, A Diagnostic Tool for Analyzing the Current-Voltage Characteristics in a-Si/c-Si Heterojunction Solar Cells, 39th IEEE PVSC, 2013.



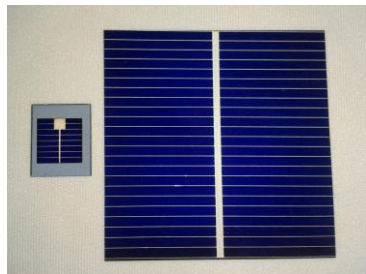
Schematic of the MEL setup



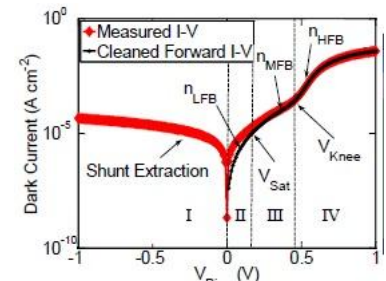
Comparison of MEL lifetime with Suns-Voc



Numerical dark I-V simulations for ideal and defective layer



Picture of samples obtained from Moser Baer Pvt. Ltd.



Measured dark I-V with regions of carrier transport

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