A Versatile Lifetime Measurement Technique and a Robust Characterization Framework (PVCore-2)

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Scientific Achievements:

Developed modulated electroluminescence (MEL) technique for relaxation time measurements of different kinds of solar cells. Developed a systematic characterization framework to extract key parameters in HIT solar cells.

Significance and Impact:

Versatility of MEL makes its widely applicable for determining effective time or response time of finished solar cells. The characterization framework will be helpful in optimizing HIT™ cell technology, but will also be relevant for any other thin-film technology dictated by similarly complex interplay of device parameters.

Research Details:

- MEL was applied to textured and non-textured Si-HJ cells to determine recombination lifetime (Fig.1).
- Using C-f, C-V (Fig. 2) and impedance spectroscopy measurements, key parameters of HIT cells were extracted and their origin were explained using simulations.

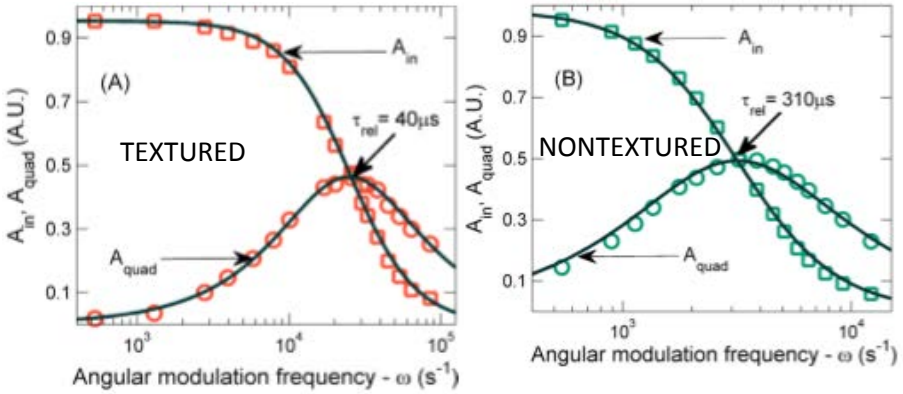

Figure 1: MEL response of a textured and a non-textured silicon heterojunction solar cell [2].

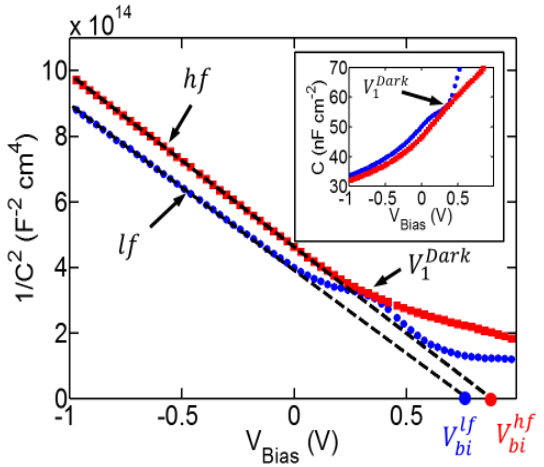

Figure 2: Simulated low- and high-frequency Mott-Schottky plots of silicon heterojunction solar cells [1].

Publications: **[1]** R. Chavali, S. Khatavkar, C.V. Kannan, V. Kumar, P.R. Nair, J. Gray, M. Alam, Multi-Probe Characterization of Inversion Charge for Self-consistent Parameterization of HIT™ Cells, *IEEE J.Photovoltaics* **5**(3), 725–735 (May 2015).
[2] S. Khatavkar, M. Kulasekaran, V. Kumar, C.V. Kannan, K.L. Narasimhan, P.R. Nair, J. Vasi , M.A. Contreras, M.F.A.M. van Hest, B.M. Arora, Measurement of Relaxation Time of Excess Carriers in Si and CIGS Solar Cells by Modulated Electroluminescence Technique, *Phy. Status Solidi A*. **215**(2), 1700267 (Jan 2018).

Contact(s): M.Alam (alam@ecn.purdue.edu); B. Arora (bmarora@ee.iitb.ac.in)