The Summer Undergraduate Research Fellowship (SURF) Symposium
7 August 2014
Purdue University, West Lafayette, Indiana, USA

Implementing the 'Frozen Potential' Approach on ADEPT to Analyze Thin Film Solar Cells

Abhirit Kanti, R. V. K. Chavali, Prof. M. S. Lundstrom, Prof. M. A. Alam
The Network for Photovoltaic Technology, Purdue University

ABSTRACT

Thin film solar cells have higher absorption coefficients than traditional Silicon solar cells. This means that lesser material is required to produce the same power output for a given intensity of solar illumination. As a result, they are less expensive, easier to install and have a wider range of applications. Analyzing the performance of cells requires separating the current into the photocurrent and the injection current based on the 'Superposition Principle'. For thin film solar cells, this cannot be done using the conventional method. This is because these components are interdependent, and so modeling one's behavior requires understanding the other. We address this issue by implementing a new modeling approach. This novel 'Frozen Potential' Approach separates the photocurrent and injection current from the total current. The currents are then plotted individually. This method is implemented on a rigorous simulation tool called ADEPT 2.0, which is readily available on nanoHUB.org – the premier platform for research and simulation in nanotechnology. Equipped with this new modelling approach, a useful framework is provided for ADEPT 2.0 by tying in a traditional understanding of solar cells to a new class of materials, geometries and illumination profiles relevant for the solar cell community.

KEYWORDS

Thin film solar cells, Superposition Principle, Current-Voltage characteristics, Simulation and Modeling.

REFERENCES

Lindholm, F. A., Fossum, J. G., & Burgess, E. L. (1979). Application of the superposition principle to solar-cell analysis. *IEEE Trans. Electron Devices, 26*(3), 165-171.

R. V. K. Chavali, J. L. Gray, and J. R. Wilcox, "Numerical Method to Separate the Photo-Current and Contact Injection Current in Solar Cells," in Photovoltaic Specialists Conference 40th IEEE, 2014.

Gray, J. L., Wang. X., Sun. X., & Wilcox. J. R. (2011). ADEPT 2.0. [Online]. Available: http://nanohub.org/resources/10913