Solar cells

This Course gives extensive exposure of underlying physical phenomena and principles of normal Silicon based and compound semiconductor based high-efficiency multi-junction solar cells.

Course Code: EE6206

Credit Hours: 3

Pre-requisite:
EE6201

Target Audience:
Grad students wishing to pursue research in the field of semiconductors, photovoltaic and its allied areas.

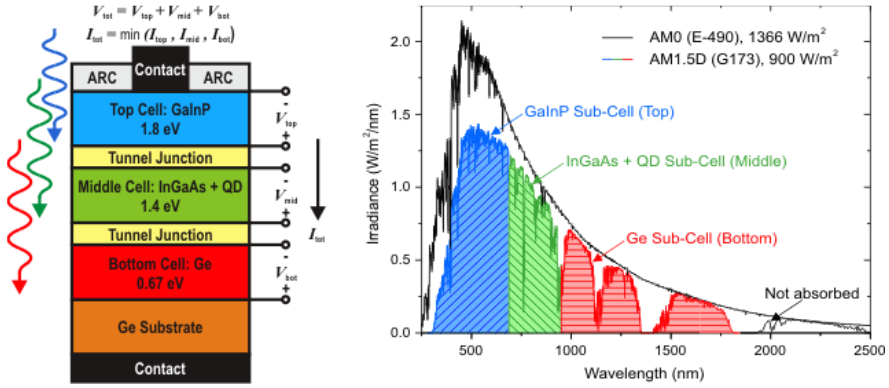

Figure 1 A high-efficiency multi-junction solar cell's epitaxial design and absorption spectra[1]

Synopsis:

With the energy demand-supply gap yawing every day and the fossil fuels depleting very fast, solar energy is one of the most prominent candidate for an alternative energy source on a global scale. With abundant sunlight all year round, covering almost all regions; it becomes even more feasible alternative energy source for Pakistan. This course is an attempt to help surmount the background knowledge barrier to do substantive research in photovoltaics.
This course is built on the fundamentals of semiconductors and investigates in detail the theoretical background of solar cells with emphasis on both the analysis and design aspects. Energy band models will be built from scratch and will be extensively used as a primary analysis tool. For complex design problems advanced simulation tools will also be used which may lead to some publishable research work.

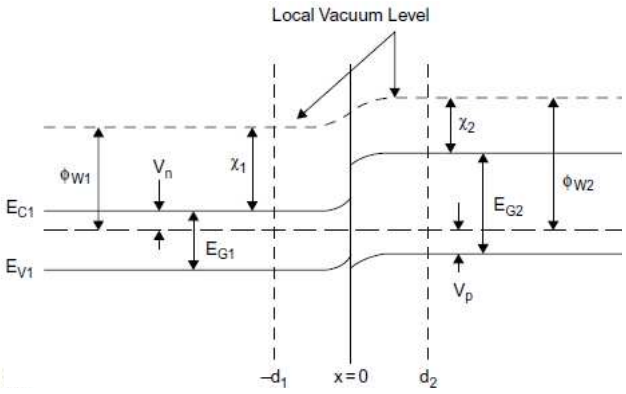

Fig. 2 Energy band model of a heterojunction interface

Instructor:

M Mohiuddin did BE (Electrical Engineering) from NED University in 1992 and MSEE from University of Nebraska, Lincoln, USA in 1996. He did his PhD in the area of compound semiconductor devices from The University of Manchester, UK in 2010. His current research interests include physical and empirical device modeling of Double Heterojunction Bipolar Transistors and High Electron Mobility Transistors for high speed, low-power digital applications.

Course Outline:

- Overview of the state-of-the-art of solar cells, solar spectrum and fundamental concepts of photovoltaics
- Overview of energy band diagram models of homo- and hetero-junctions
- Carrier transport in semiconductors including carrrier generation and recombination (R-G) processes
- Si-based solar cells—analysis of homojunction solar cells, basic overview of numerical approach
- Multijunction solar cells— overview of high efficiency solar cells, device physics of compound semiconductors, analysis and design of multijunction solar cells

Textbook:

1. S Fonash. *Solar Cell Device Physics*— 2nd edition (2010)

[1] http://sunlab.site.uottawa.ca/research.php