

Advanced Photovoltaics

EEE 598 – Special Topics

Spring 2016

Course Objective: This course will examine the basic charge transport, optical, and materials science issues affecting conversion of light to electrical energy in solar cells. Students will gain an understanding of recombination physics, electronic activity of defects, electrochemical potential, and the thermodynamics of solar cells. We will also explore key issues for several technologically important types of photovoltaic cells: crystalline silicon cells, multijunction cells, and thin-film polycrystalline compound semiconductor solar cells such as Cu(Ga,In)Se₂ and CdTe.

Prerequisites: Fundamentals of semiconductor materials and devices, solar cell principles

Topics: Overview of electric power demand on Earth
Review of solar cell device physics
Crystal structure
Semiconductor band structure
Technologically important PV technologies
PV device band diagrams
Solar spectrum, availability of solar radiation
Photogeneration
Light concentration and cell optics
Bulk recombination
Surface recombination
PV device physics
Solar cell efficiency limits - detailed balance
Novel solar cell principles and designs
PV modules and systems
Considerations for terawatt PV, elemental abundances

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Class Hours: MW 4:30 – 5:45 pm, SCOB 302

Office Hours: Tuesdays 3-4 pm and Thursdays 10-11 am (exceptions announced in class)
For meetings outside regular office hours, please contact Jenna Snowberger, (480) 965-3776, jmartura@asu.edu. You can also reach me by email and I will try to respond as promptly as possible.

Required Textbooks: Angus Rockett, *The Materials Science of Semiconductors*
Springer Science+Business Media, 2008, ISBN 978-0-387-25653-5.

Peter Würfel, *Physics of Solar Cells*
Wiley-VCH, 2009, ISBN 978-3-527-40857-3.

Supplementary: Please see the Blackboard website for references and supplementary reading.

Quizzes: Quiz dates will be announced in class about one week beforehand.

Final Exam: **Week of May 2 - 7**

Grading:	Homework	35%	(7 HW assignments, 5% each)
	Class participation	5%	(2% attendance, 3% class questions and answers)
	Quizzes	30%	(4 quizzes, lowest score dropped, 10% each)
	Final exam	30%	