

EE 298-12  
Solid State Technology and Devices Seminar  
Friday, 7 February 2014  
1-2pm  
540A/B Cory Hall

## **New Materials for Solar Energy Conversion**

**Dr. Kin Man Yu**

Materials Sciences Division  
Lawrence Berkeley National Laboratory

### **Abstract**

Recent progress in the understanding of properties of complex semiconductor materials has opened new possibilities for designing semiconductor materials with the electronic band structure optimized for specific device applications. In this talk I will give an overview on our recent research on novel semiconductors for solar power conversion devices, including group nitrides, highly mismatched alloys and transparent conductors. The potential applications of these materials for solar energy conversion devices, including multijunction and intermediate band solar cells and photoelectrochemical water splitting will be discussed. In particular, I will focus on our recent efforts on the development of transparent conductors for full spectrum photovoltaics. We found that with appropriate intentional doping, cadmium oxide can be an ideal uncompensated material with extremely high mobility ( $>150 \text{ cm}^2/\text{Vs}$  with  $n \sim 10^{21}/\text{cm}^3$ ) and hence high conductivity ( $>10^4 \text{ S/cm}$ ). In addition, an excellent transmission window in the range from 400 to  $>1500 \text{ nm}$  can be achieved. These properties make CdO an appropriate TCO for photovoltaics with low band gap absorbers including Si and high efficiency multijunction cells.

**Kin Man Yu** received a B.S. (1982) in Engineering Physics and a Ph. D. (1987) in Materials Science and Mineral Engineering, both from the University of California, Berkeley. Currently, he is Staff Scientist and Principal Investigator in the Materials Sciences Division at the Lawrence Berkeley National Laboratory. Together with Dr. Wladek Walukiewicz, he co-leads the Solar Energy Materials Research Group (<http://emat-solar.lbl.gov/home>) and also serves as the director of the Ion Beam Analysis Facility at LBNL (<https://sites.google.com/a/lbl.gov/rbs-lab/>). Dr. Yu has been performing fundamental research on synthesis as well as structural, electrical and optical properties of electronic materials and ion beam modification and analysis of materials for over 25 years. He has published over 400 journal articles with about 10,000 total citations. He has also coauthored 9 book chapters and invited reviews and holds several patents related to the materials for photovoltaic applications. Together with Dr. Wladek Walukiewicz, he received the 2006 R&D 100 award (Editor's choice for most promising technology) for their work on multiband semiconductors for high efficiency solar cells.