



# WPI

## MATERIALS SCIENCE & ENGINEERING

### Lite Zhou

#### PhD Doctoral Proposal

**Wednesday, December 6, 2017**  
**1:00 PM**  
**Higgins Lab 102**



#### Advisor:

Prof. Pratap Rao

#### Committee:

Prof. Richard Sisson Jr. Prof.  
Lyubov Titova

(Physics)

Prof. Yan Wang

Prof. N Aaron Deskins

(Chemical Engineering)

### Novel Nanostructured Metal Oxides for Efficient Solar Energy Conversion

#### *Abstract*

Metal oxide materials could offer earth-abundant, non-toxic alternatives to existing light-absorber materials in thin-film photovoltaic and photoelectrochemical cells. However, efficiency of these devices based on existing metal oxides is typically low due to poor material properties. In this research, novel Sb: SnO<sub>2</sub> nanowire electron collector has been synthesized, investigated and was used to improve the photo-conversion efficiency of top-performing BiVO<sub>4</sub> photoelectrochemical cell. The performance of Sb: SnO<sub>2</sub>/BiVO<sub>4</sub> achieved a new record for the product of light absorption and charge separation efficiencies ( $\eta_{\text{abs}} \times \eta_{\text{sep}}$ ) of ~ 54.3% and 56.3% under front- and back-side illumination at 0.6 VRHE. In addition, a new promising metal oxide material (BiCuW<sub>2</sub>O<sub>8</sub>) has been synthesized and investigated to make photovoltaic cell which has potential to achieve over 30% solar power conversion efficiency.