Developing lab modules for Community Colleges

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Outline

- ***Demographics in the US***
- ***Higher Education in the US***
- ***Higher Education in the State of Washington***
- ***Partnership between the University of Washington and Green River Community College***
- ***Lab module development***
- ***Outcomes so far***

Demographic in the US in 2010

Race/Ethnicity	Number	Percentage of the US population
Total	308,745,538	100%
Caucasian	196,670,907	63.7%
Hispanic or Latino	50,477,592	16.4%
African American	38,929,319	12.6%
Asian American	14,674,252	4.8%
Native Americans or Alaska Native	2,932,248	0.9%
Native Hawaiian or other Pacific Islander	540,013	0.2%

Household income distribution from 2005 censor

Large income disparity in the US and the difference is growing

There is a difference between median income based on ethnicity

Percentile	Income range
0-10%	$0-$10,500
10-20%	$10,500-$18,500
20-25%	$18,500-$22,500
Middle	
75-80%	$77,500-$92,000
80-95%	$92,000-$167,000
95-98.5%	$167,000-$250,000
98.5-99%	$250,000-$350,000
99-100%	>$350,000

Median income			
Asian	Caucasian	Hispanic	African American
$57,718	$48,977	$34,241	$30,134

Median household income based on educational attainment

Large difference in income depending on educational attainment.

Educational level	Median income
Some High School	$22,718
High School Graduate	$36,835
Some College	$45,854
Associate's Degree	$51,970
Bachelor's Degree	$68,728
Master's Degree	$78,541
Professional Degree	$100,000
Doctorate Degree	$96,830

Do decrease disparity in income levels, there is a need to ensure minority students pursue higher degrees.

Higher Education in the US

Community Colleges

- Two year Colleges
- Lower tuition than other schools
- Graduate with an Associates Degree
- Encouraged to transfer to four year Colleges after graduation

Liberal Arts Colleges

- Four year Institutions with a focus on the liberal arts
- Private schools
- Small class sizes
- Undergraduate students only

Universities

- Research-based Institutions with both undergraduate and graduate education
- State and private schools

Higher Education in the US

Community Colleges (~$3000/yr)

- Two year Colleges
- Lower tuition than other schools
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Liberal Arts Colleges (~$30,000/yr)

- Four year Institutions with a focus on the liberal arts
- Private schools
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- Undergraduate students only

Universities (~$30,000/yr for private schools, ~$15,000/yr for State schools)

- Research-based Institutions with both undergraduate and graduate education
- State and private schools

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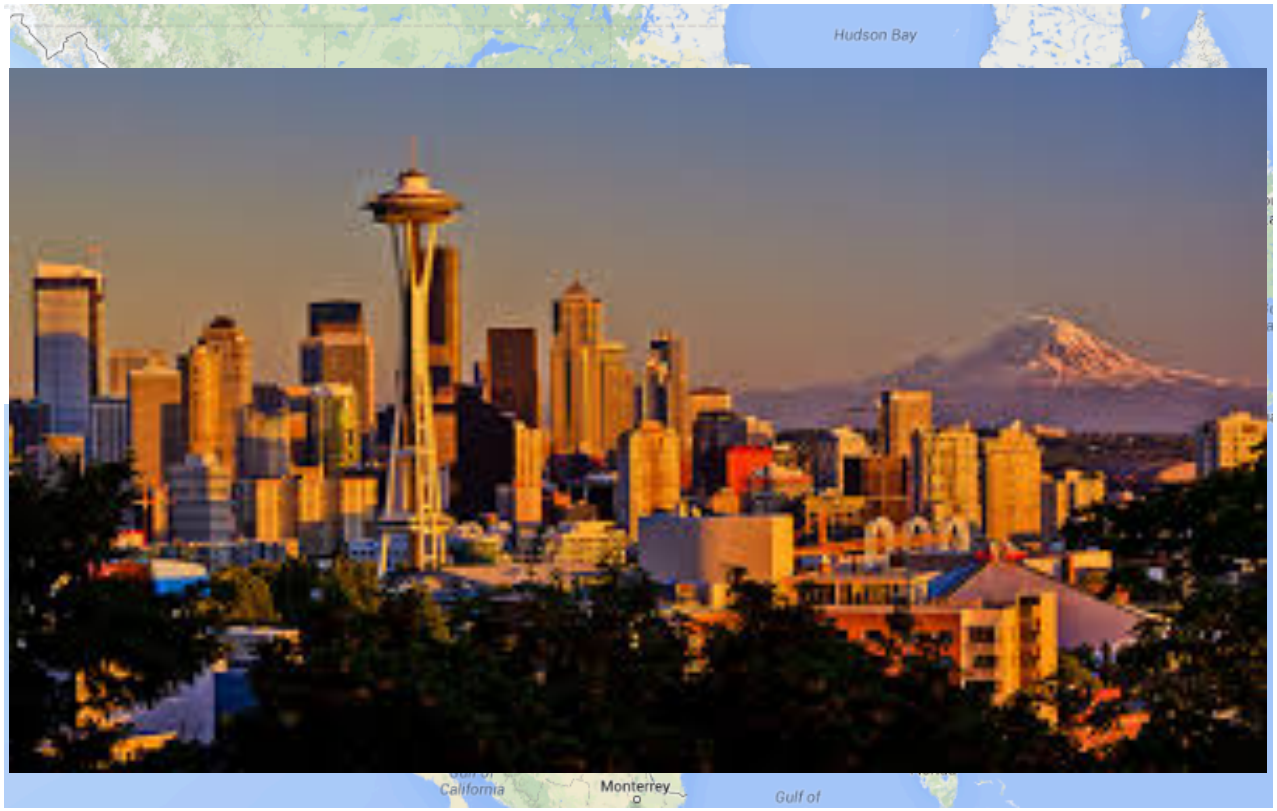
University of Washington, Seattle



Higher Education in the State of Washington

State of Washington population: 6.9 million

29 Community Colleges

6 State Universities

- University of Washington
- Washington State University
- Western Washington University
- Central Washington University
- Eastern Washington University
- The Evergreen State College

30 Private Institutions

University of Washington

- ***Flagship University for the State of Washington***

- Founded in 1861

- Total of ~42,000 students
  - ~28,000 undergraduates
  - ~14,000 graduates

- ~4000 faculty

- Brings in $1.15 billion of research funds – brings in the largest amount of federal funds out of all the public Universities in the country

- Ranked 16th in the world by China's Shanghai Jiao Tong University

- Ranked 6th in US and 8th in the world for academic performance by Middle East Technical University (Turkey)

- ***The University reserves 30% new undergraduate spaces to Community College transfers***

Challenges faced by Community College students when transferring

- Transfer from small class sizes to huge class sizes
  - Feel lost
  - Don't feel supported
- Lacking in basics in maths, chemistry, physics etc.

- Lacking in laboratory skills

- Introduce students to the 4-year Institutions at an earlier stage

- Provide hands-on experience to Community College students

Working with Green River Community College

•NSF funded project in collaboration with Prof. Chitra Solomonson (Physics Professor at Green River Community College)

Goal:
Help Community College students to enter four-year Universities and graduate programs

Method:
Expose Community College students to the latest research occurring at Research Institutions

Rationale:
Research has shown that students with undergraduate research opportunities are more likely to complete STEM undergraduate degrees.

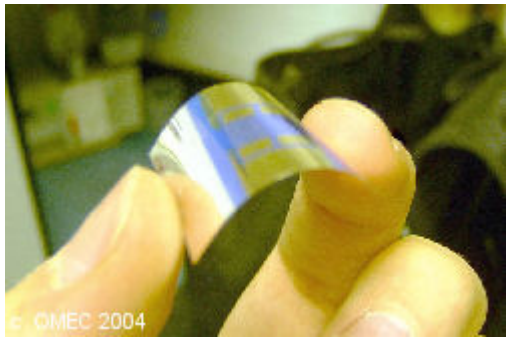
Organic semiconducting materials

Conjugated organic materials are an attractive alternative to traditional inorganic materials

- Light weight
- Low cost
- Flexible
- Disposable

Applications include:

- Light-emitting devices
- Field-effect transistors
- Photovoltaic devices



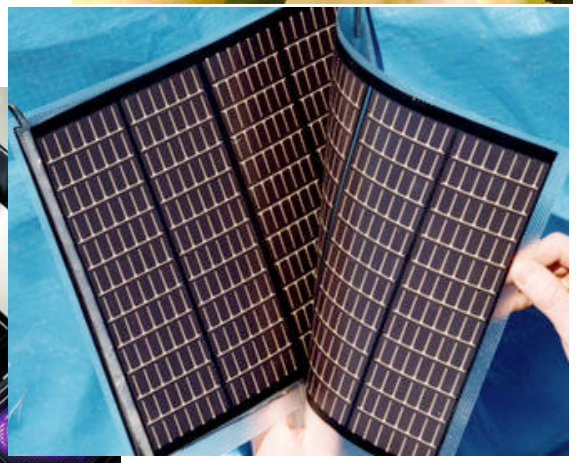
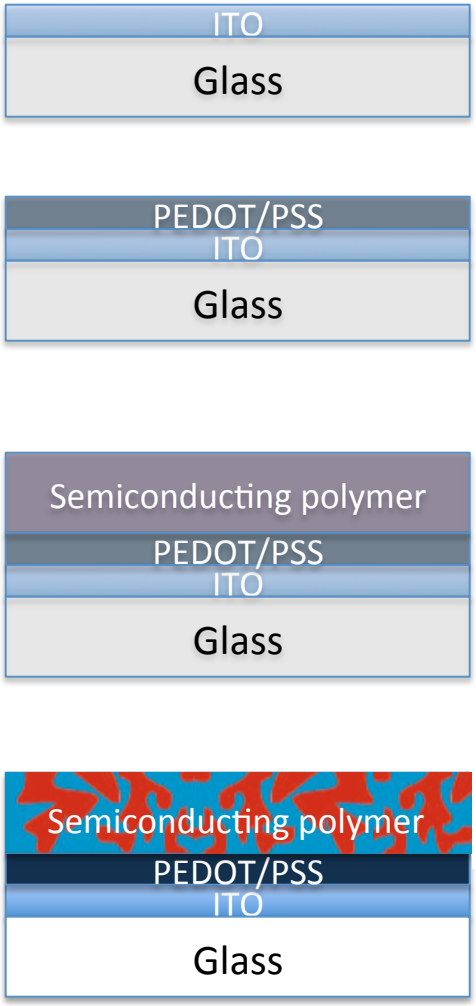


Photo: Global Photonic Energy Corp

Photo: Optimus Keyboards

How to make an OPV



1. Clean ITO by sonication with organic solvents followed by treatment with plasma cleaner
2. Spin coat PEDOT/PSS
3. Prepare polymer solution (P3HT:PCBM)
4. Spin coat polymer solution
5. Anneal polymer film
6. Evaporate top electrode (Al)

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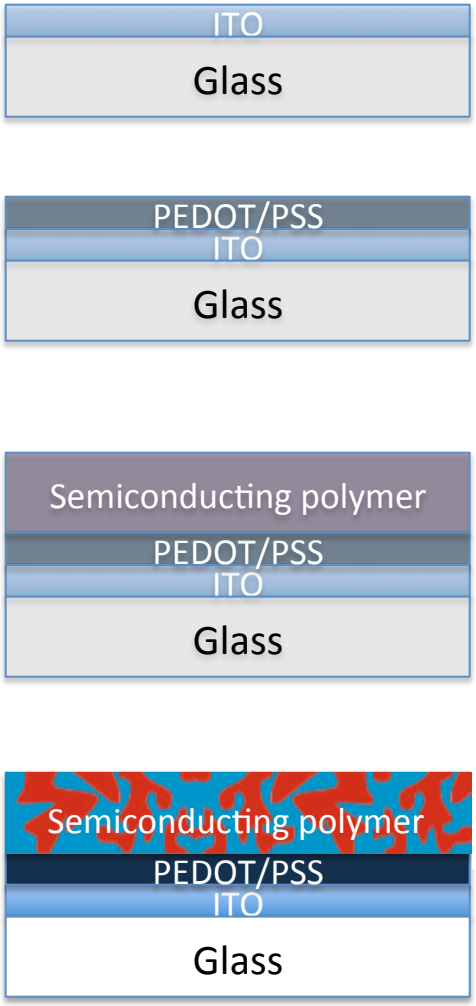

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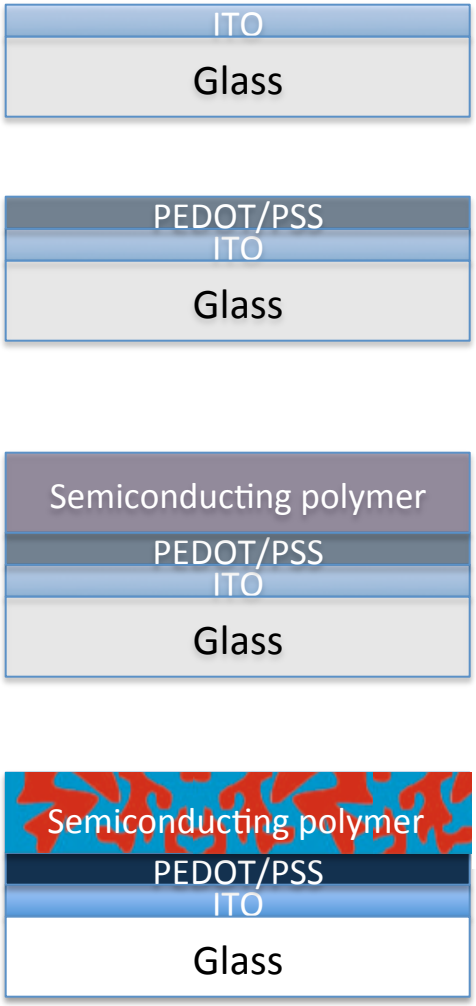

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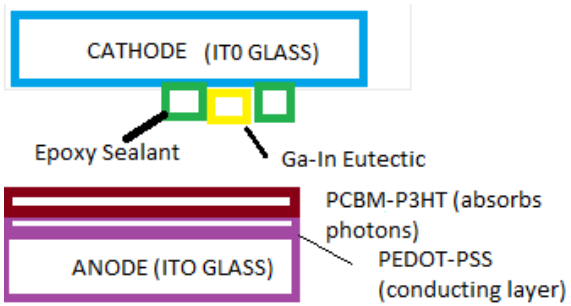
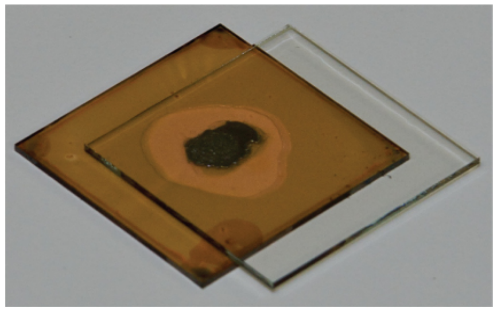
Our solution





- Sacrifice device performance while enabling investigation of basic scientific concepts
- Forgo cleaning of ITO
- Make devices in air but seal with epoxy and glass for protection
- Instead of evaporating top electrode, use a Ga-In eutectic
- Alter thickness of layer, annealing time, ratio of PCBM-P3HT and investigate/understand how and why these parameters alter device performance
- Research culminates with a written research report

Survey

- What the primary reasons you enrolled in the course?
- What is the highest level of education that you plan to achieve?
- What do you view as obstacles for you to attend a 4-year University?
- How much do you know about the following topics?
  - Organic photovoltaics
  - Scientific methods
  - Scientific problem solving
  - Careers in Science, Math or Engineering
  - Transition requirements to a 4-year University
- Did course participation…
  - increase you interest in science?
  - influence your view of the role of science in your future?
  - make you more confident in your ability to succeed in science?
  - lead you to better understand your own career goals?
  - increase your interest in a 4-year University?

Outcomes

- 38 students participated (27 male, 11 female)
- Only 2 reported that their highest level of education would be an Associate's degree.
- 76% reported that their greatest barrier to higher education is financial.
- Statistically significant difference in their knowledge of OPV and their confidence in scientific problem solving.
- Positive trends in their knowledge of scientific methods, careers and transition to a 4-year university.
- All recognized that pursuing a STEM major in a 4-year university would lead to better paid jobs.
- ***Biggest determining factor for their change in attitude was the instructor that they had in their lab section.***

Group

Current members

- Jeremy Housekeeper
- Jason Lee
- Trevor Martin
- Katherine Mazzio
- Dr. Ken Okamoto
- Andrew Rice
- Dr. Prakash Sista
- Pinyi Yang
- David Zeigler

Past members

- Dr. Shane Boyd
- Dr. Tricia Bull
- Dr. Hugo Bronstein
- Dr. Natasha Doubina
- Dr. Matt Durban
- Dr. Dan Liu
- Dr. Peter Kazarinoff
- Dr. Mingjian Yuan

Prof. Chitra Solomonson