
2008 Solar Annual Review Meeting

Session: OPV, Sensitized, Seed

Company or Organization: NREL

Funding Opportunity: SETP Seed Fund



Jeff Blackburn

National Renewable Energy Laboratory

jeffrey_blackburn@nrel.gov

ph: 303-384-6649





Carbon Nanotube (CNT) Architectures for PV

<i>National Renewable Energy Laboratory</i>			
Project Beginning Date	FY07 Budget	FY08 Budget	Total Budget
Jan. 2008	\$0.085 millions	\$0.30 millions	\$0.3085 millions

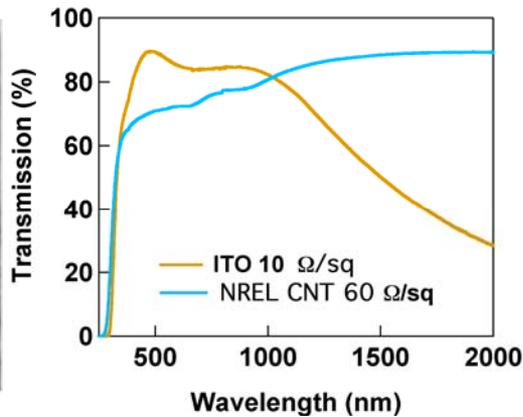
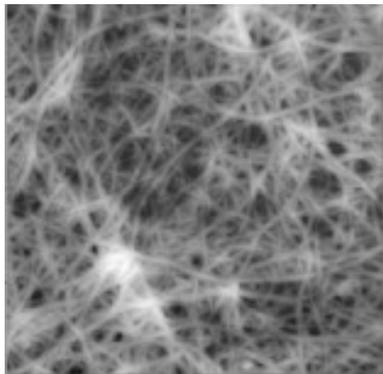
- This project supports the Solar America Initiative by:
 - Developing high performance transparent conducting electrodes based on inexpensive and scalable materials (CNTs) and processes (spray deposition).
 - Lower cost of solar electricity based on advantages of CNT electrodes.
 - Material availability and cost (Carbon)
 - Scalable spray deposition
 - Low cost deposition - room temperature, atmospheric pressure

Project Overview



- Goal – scalable, inexpensive, high η solution-processed PV using CNT electrodes as transparent conductors

3D inter-connected networks of CNTs form highly conductive transparent films with good T, R_s

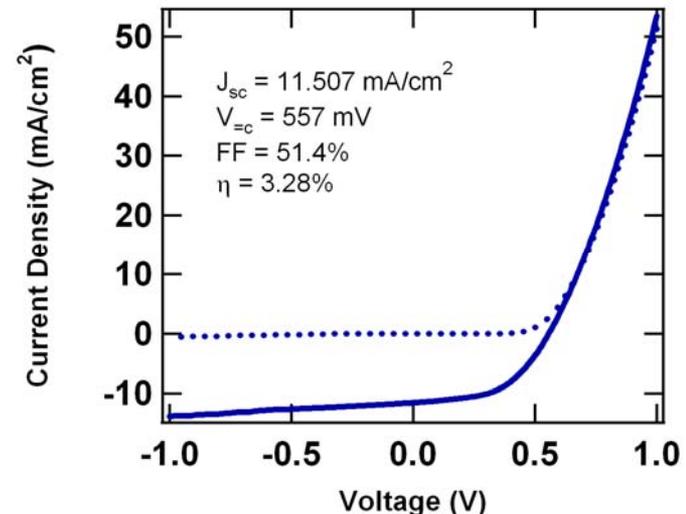


Ultra-sonic sprayer



1 x 4 inch

- Discovered favorable conditions for spraying process and post processing conditions.
- Performance approaching FY08 milestone.
- Improved efficiency with OPV devices compared to all previous devices employing CNT electrodes



Project Alignment with Technology Roadmap



What needs in the Technology Roadmap are your project responding to?

From the draft OPV roadmap:

Need	Significance
Optimization of complete device architecture, including active layer, buffer layers, and electrode and transparent conducting oxide materials.	Develop a complete device geometry that harnesses the power captured in the active layer.
High-throughput fabrication techniques for scale-up to larger-area devices and atmospheric processing.	Develop large-area, high-speed fabrication techniques that retain the efficiency of laboratory-scale cells.

What approaches are you using to address those needs?

1. Optimizing CNT electrodes for transparent conductors to replace traditional TCs (e.g. ITO).
2. Focusing only on scalable processing conditions for a material that is ideally suited to solution-phase, atmospheric processing.

Project Update

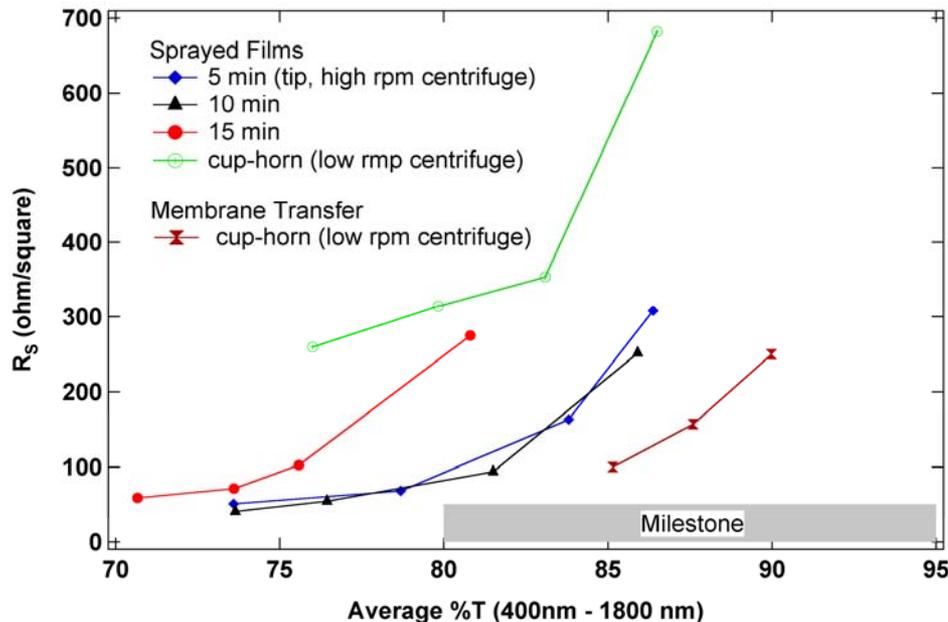


		Planned work since last Program Review	Status
		↑ Past	Project Initiated
Hire Post-Doctoral or Staff Researcher	Achieved Jan-08		
Purchase Ultra-Sonic Sprayer	Achieved Jan-08		
Complete Installation of Sprayer	Anticipated Jun-08		
Future ↓	Sprayed CNT Electrode with 80%T, 50 ohm/sq, 1 cm ²	Anticipated Oct-08	
	Evaluate performance of sprayed CNT electrodes in OPV devices: Certified 1 cm ² OPV Device	Anticipated Dec-08	
	Demonstrate photo-effect with CNT absorber in Shottkey barrier or photoelectrochemical cell	Delayed until FY09	

Obstacle Discussion



- Barriers encountered or anticipated that may inhibit success of programs
 - Simultaneous optimization of transparency and sheet resistance.



Team and Collaborators



- Teresa Barnes, Michael Heben, Robert Tenent, Jao van de Lagemaat, Anthony Morfa, Miguel Contreras, Ginley group
 - OPV: *Appl. Phys. Lett.* **2006**, 88, 233503.
 - CIGS: *J. Phys. Chem. C* **2007**, 111, 14045.
 - CdTe: *Appl. Phys. Lett.* **2007**, 90, 243503.