Process Technology and Advanced Concepts: Organic Solar Cells

Organic solar cells are one of the research focuses within the Process Technology and Advanced Concepts Group. The group also works in the areas of high-throughput combinatorial material science and atmospheric processing, which are discussed in another capabilities sheet.

Scope. The Organic Photovoltaics (OPV) team develops and applies new absorber, contact, and barrier materials to advance the device performance and lifetime of organic solar cells.

We have a longstanding focus on developing new contact materials and device architectures. This success has led to one of the first demonstrations of inverted OPV devices that are now exhibiting greatly enhanced device lifetime by eliminating unstable contact and electrode materials.

We continue to develop new electron/hole contact layers for increased lifetime and device performance. Additionally, we have developed both a team and the tools for the intelligent design and synthesis of new absorber/donor materials that will help to further enhance the performance and lifetime of organic solar cells.

Finally, we have developed a combinatorial degradation system that allows us to measure lifetime of thin-film devices under light, at different substrate temperatures, with or without filters or under different duty cycles. This enables us to evaluate the lifetime of a large number of samples under the same or varied conditions in a parallel manner, allowing for very efficient lifetime measurements.

Core Competencies and Capabilities. The OVP team specializes in solution deposition of organic and inorganic thin films by spin coating or spray deposition in an inert atmosphere.

We also have the following capabilities:

- A thermal evaporator, which is housed in an inert environment, that is available for metal evaporation for completing devices.
- A solar simulator, external quantum efficiency, Kelvin probe, probe station, and impedance spectroscopy in an inert atmosphere.
- Hood space for organic synthesis capabilities.

In addition, we have developed combinatorial computational molecular design tools for quickly evaluating large numbers of molecules for electronic and optical properties.

Contact

Dana Olson, Dana.Olson@nrel.gov, 303-384-6675
Web: www.nrel.gov/pv/advanced_concepts.html

National Renewable Energy Laboratory
15013 Denver West Parkway, Golden, CO 80401
303-275-3000 • www.nrel.gov

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