



RESEARCH, DISCOVERY & INNOVATION

# Institute for Energy Solutions

Institute for Energy Solutions Energy Talks

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Summary Report

## **Researchers share insights into thin solar cells at IES Energy Talks event**

On September 19, two researchers from the University of Arizona shared information about thin solar cells with patrons of the Sky Bar. This event was the latest in the Energy Talks series, organized by the University of Arizona's Institute for Energy Solutions. At this Energy Talks event, Erin Ratcliff, Assistant Professor of Materials Science and Engineering, gave an overview of the low-cost printable solar cells being developed by her research group, and James Stanfill, PhD candidate in Chemistry and Biochemistry, discussed the various methods that he and other researchers are using to determine how the surfaces of thin solar cells could be improved in order to more efficiently capture energy from the Sun.

Erin Ratcliff's five "favorite elements", as she calls them, are all located near the top of the periodic table. These five elements - Carbon, Nitrogen, Oxygen, Fluorine, and Sulphur - are present on Earth in abundance, making them low cost and easy to obtain. These five elements can be combined in strategic ways by chemists to create millions of molecules that when exposed to light conduct electricity. When printed in the right combinations, these molecules form organic thin-film solar cells, also called "organic photovoltaics". By methodically mixing and matching these elements to see which combinations work the best, the efficiency of organic photovoltaics has been rapidly improved in the last ten years (3% to >16%), thereby becoming increasingly attractive as a low-cost alternative to conventional solar panels.

Ratcliff's research is focused on developing flexible, environmentally-safe electronics which could improve the safety and affordability of medical devices and solar power systems. Her Energy Talks presentation, titled "Printing our energy future: sunlight into electricity and fuel" discussed not only energy generation, but also energy storage. Ratcliff's group is working to build "artificial leaves", allowing photovoltaics to produce storable fuels through a process similar to photosynthesis. The fuels produced by these artificial leaves would be a renewable alternative to fossil fuels.

James Stanfill's Energy Talks presentation, titled "Big Machines and Big Science: Peering into the Atomic World of the Next Solar Cells", provided a look into the challenges and potential uses of perovskite solar cells, a different type of thin-film photovoltaics named for the mineral perovskite which shares the same type of crystal structure. While the organic photovoltaic materials that Erin Ratcliff studies are defined by their constituent elements, perovskite solar cells are defined by their microscopic structure as a crystalline material - namely how the crystals are shaped and organized within the solar cell. Stanfill, with the help of electron microscopes and other large machines, looks very closely at the internal surfaces and layers of

perovskite photovoltaics to study perovskite crystal defects and behaviors resulting from how the solar cells were made. By studying those properties and finding ways to improve them, perovskite solar cells can be made more efficient - and more economical.

Perovskite solar cells are a competitor to organic solar cells, with both types presenting various challenges and benefits. While perovskite photovoltaics are currently superior to organic photovoltaics in terms of efficiency, both types are already efficient enough to be commercially viable, and they just keep getting better. Thin-film photovoltaics, whether they are made of organic materials or of perovskites, are figuratively and literally more flexible than their rigid conventional counterparts, and have the potential to make renewable energy more accessible to everyone. Research being done here at the University of Arizona is helping to make that a reality.

For more information about energy-related research at the University of Arizona, visit [energy.arizona.edu](http://energy.arizona.edu).