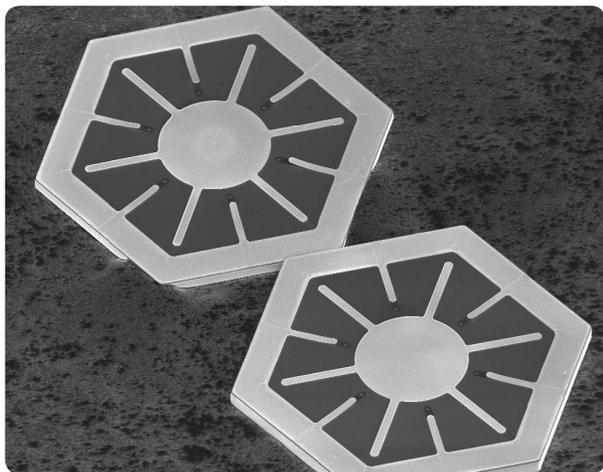


MICROSYSTEMS ENABLED PHOTOVOLTAICS (MEPV)

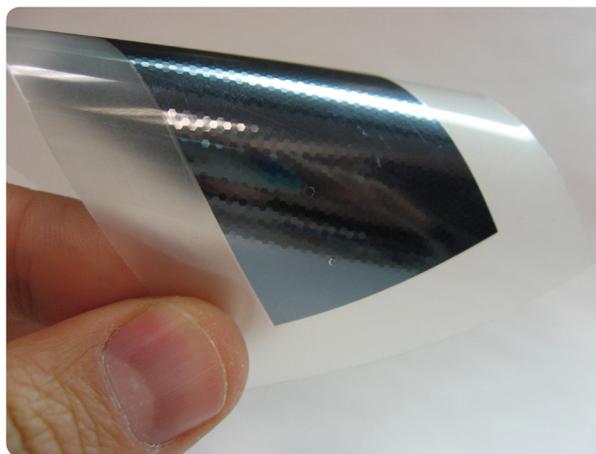
Sandia National Laboratories' Microsystems Enabled Photovoltaics (MEPV) cells are a revolutionary solar technology that will change how we convert light to electricity. Sandia inventors designed three different microscale photovoltaics cells based on efficiency, cost and application. These microscale PV cells are the size of a period at the end of a sentence (3-20 microns thick and 100-1000 microns wide). Our micro PV cells are constructed using established microfabrication technology and tools currently utilized in the MEMS, LCD, and LED industries, eliminating the need for new and costly manufacturing tools. Electrical contacts are located on the backside of each cell, freeing up the front side for optimal light absorption.



Scanning electron microscope image of two microscale crystalline silicon photovoltaic cells with radial contacts on back

Backside contacts also produce a more uniform and aesthetically pleasing front without electrical lines. Sandia has developed efficient methods to transfer these micro cells into functional modules. Cells are either placed or printed onto a flexible substrate, incorporated into the molding process of rigid objects, or used in a flat plate format, all depending on the application.

They can be interconnected and configured to provide high voltage (100 V) in less than 1cm² space and they can operate without DC-to-DC converters, reducing resistive loss, improving shading performance, and enhancing robustness to individual cell failures.



Model of flexible PV module

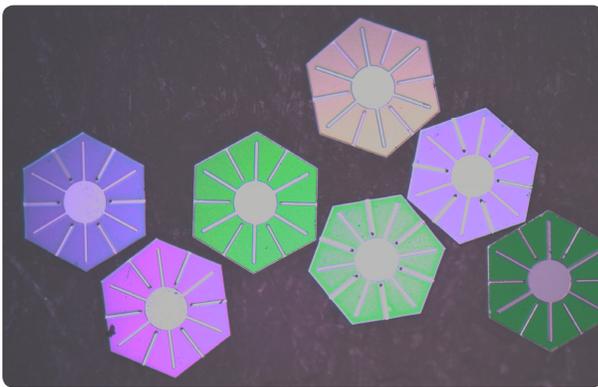
The miniaturized PV cells also allow for independent electrical connections thereby overcoming the operational handicaps of lattice and current matching found in commercial multi-junction PV cells. This has the potential for a PV system with greater than 50% conversion efficiency.

As with traditional photovoltaic cells, energy is generated when light (natural or artificial) excites electrons embedded in the microscale PV cell, which in turn flow through the substrate material and are collected at the terminals. Sandia developed micro-concentrators that add less than 1 cm of thickness, while increasing light concentration levels up to 400x, reducing the cost and complexity of sun tracking.

MICROSYSTEMS ENABLED PHOTOVOLTAICS (MEPV)

Sandia researchers further increased the functionality of MEPV by developing an anti-reflective coating that can add color to MEPV cells, turning them into a design element or allowing them to blend inconspicuously into their surroundings. Designers and architects can incorporate MEPV cells into their designs to provide building occupants with a renewable source of energy without compromising the overall look and feel of the building. Improving the aesthetics of photovoltaics increases the number of potential applications.

Microscale photovoltaic cells provide a solution to restrictions presented by large, commercially-available photovoltaic technologies. Reduction in size and cost, while incorporating color and versatility allows for more diverse applications of Microsystems Enabled Photovoltaics.



Micro PV cells shown in a variety of colors

With MEPV, solar power can move from the rooftops and onto any surface requiring a source of energy.

TECHNICAL BENEFITS

- Reduction in size, weight and cost
- Increased efficiency & solar tracking
- Portable and lightweight
- Colored anti-reflective coating
- Easily customizable to meet specific voltage and output needs
- Flexible, moldable or flat-plate format
- Improvements in shade & damage tolerance

INDUSTRIES & APPLICATIONS

- Portable Electronics
- Battery Charging
- Architecture & Design
- Defense
- Transportation
- Clothing and textiles
- Manned & Unmanned aircraft
- Satellites