

NREL Solar Cell Sets World Efficiency Record at 40.8 Percent

August 13 2008

(PhysOrg.com) -- Scientists at the U.S. Department of Energy's National Renewable Energy Laboratory (NREL) have set a world record in solar cell efficiency with a photovoltaic device that converts 40.8 percent of the light that hits it into electricity. This is the highest confirmed efficiency of any photovoltaic device to date.

The inverted metamorphic triple-junction solar cell was designed, fabricated and independently measured at NREL. The 40.8 percent efficiency was measured under concentrated light of 326 suns. One sun is about the amount of light that typically hits Earth on a sunny day. The new cell is a natural candidate for the space satellite market and for terrestrial concentrated photovoltaic arrays, which use lenses or mirrors to focus sunlight onto the solar cells.

The new solar cell differs significantly from the previous record holder – also based on a NREL design. Instead of using a germanium wafer as the bottom junction of the device, the new design uses compositions of gallium indium phosphide and gallium indium arsenide to split the solar spectrum into three equal parts that are absorbed by each of the cell's three junctions for higher potential efficiencies. This is accomplished by growing the solar cell on a gallium arsenide wafer, flipping it over, then removing the wafer. The resulting device is extremely thin and light and represents a new class of solar cells with advantages in performance, design, operation and cost.

NREL's Mark Wanlass invented the original inverted cell, which

recently won a R&D 100 award. His design was modified by a team led by John Geisz that further optimized the junction energies by making the middle junction metamorphic as well as the bottom junction.

Metamorphic junctions are lattice mismatched – their atoms don't line up. The material properties of the mismatched semiconductors allows for greater potential conversion of sunlight.

Provided by NREL

Citation: NREL Solar Cell Sets World Efficiency Record at 40.8 Percent (2008, August 13)
retrieved 19 September 2024 from

<https://phys.org/news/2008-08-nrel-solar-cell-world-efficiency.html>

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