

Photons serve double duty

2011 R&D 100 Winner



Furnaces are a critical step in the manufacturing of billions of solar cells annually, but they demand significant resources to operate. After two decades of research on optical processing technologies, which has included 12 related patents, researchers at **National Renewable Energy Laboratory**, Golden, Colo., have learned that greater precision in the manufacturing process occurs by taking double advantage of photons. The photons can be used not only to heat the semiconductor wafer; the photonic effects that occur within the structure of the semiconductor can control mass transport within the semiconductor device.

This understanding has led NREL to develop, with partner **AOS Solar Inc.**, Torrance, Calif., a new type of photovoltaic manufacturing tool, the **Optical Cavity Furnace**, which uses light enclosed within a highly reflective chamber to achieve a level of temperature uniformity. A geometric design and a lining of ceramic materials in the cavity walls virtually eliminates energy loss and helps reduce solar wafer process time to just a few minutes.

The furnace focuses energy on the wafer only, producing solar cells with absolute conversion efficiencies increased by 0.47%, which is a 3 to 4% jump in relative efficiency. Plus, the cost of the Optical Cavity Furnace is only one-quarter to one-half that of a standard industrial thermal or infrared furnace.

Technology

Photovoltaic manufacturing tool

Developers

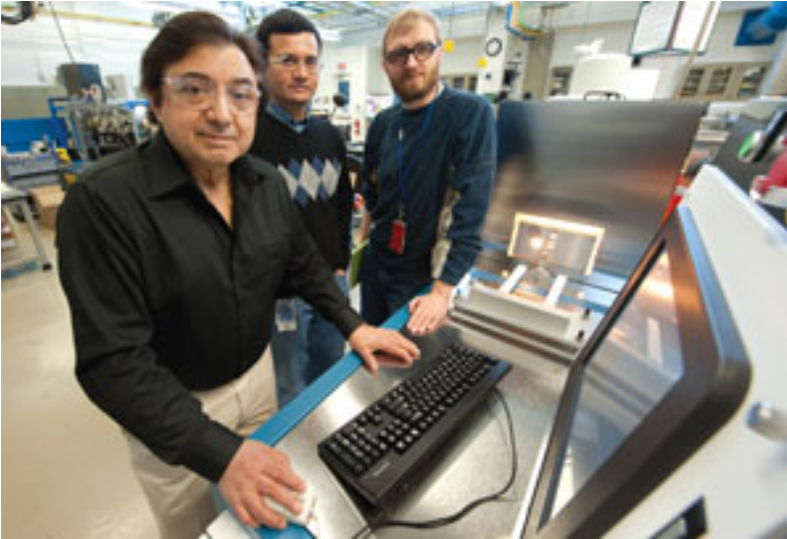
[National Renewable Energy Laboratory](#) [1]

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Development Team

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