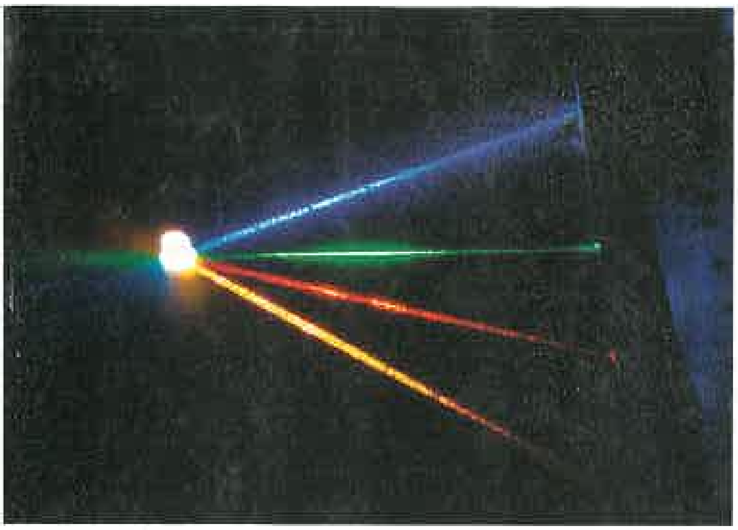


Four laser beams – yellow, blue, green and red – converge to produce a pleasantly warm white light. Results suggest that diode-based lighting could be an attractive alternative to increasingly popular LED lighting, itself an alternative to compact fluorescent lights and incandescent bulbs.

blocks to further research in this area," said Neal Singer, a science writer at Sandia, adding that more research to compact various diode laser light sources must be conducted.

Diode lasers are slightly more expensive to fabricate than LEDs because their substrates must have fewer defects than those used for LEDs. Still, such substrates are likely to become more available because they improve LED performance as well, the researchers say.

Although blue diode lasers perform well enough that BMW AG plans to use them in its vehicles' next-generation white headlights, the performance of red diode lasers is not as good, and yellow and green have a ways to go before they are efficient enough for commercial lighting.

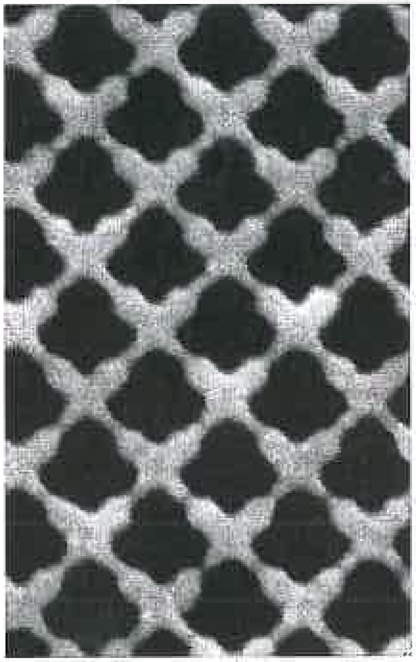
The study was published in *Optics Express* (dx.doi.org/10.1364/OE.19.00A982) on July 1, 2011.

Super absorber could boost efficiency in solar cells

EVANSTON, Ill. – A new material that absorbs a wide range of wavelengths could lead to more efficient, less expensive solar technology.

Solar cells are only as efficient as the amount of sunlight they collect. Unlike a laser, the solar spectrum is "very broadband," ranging from the ultraviolet to the near-infrared, so a solar cell needs a broadband response to capture this light most efficiently, said Koray Aydin of Northwestern University's McCormick School of Engineering and Applied Science.

To achieve this, Aydin and colleagues used unconventional materials – metal and silicon oxide – to create thin but complex trapezoid-shaped metal gratings on the nanoscale level that can trap a wider range of visible light. On their own, the two materials do not absorb light; however, when used together on the nanoscale, they achieve very high absorption rates.



A scanning electron microscope image of broadband plasmonic superabsorbers. Proposed arrays of crossed trapezoidal metallic elements yield broadband, polarization-independent optical absorption. Courtesy of Koray Aydin, Northwestern University.

The research is not directly applicable to solar cell technology because metal and silicon oxide cannot convert light to electricity. In fact, the photons are converted to heat and might allow novel ways to control the heat flow at the nanoscale. However, the innovative trapezoid shape could be replicated in semiconducting materials that could be used in solar cells.

"If we can turn a reflective metal and transparent dielectric to an absorbing material through optical design and nanofabrication, we can surely use it for increasing the absorption in semiconductors, which are already absorbing," Aydin said.

If applied to semiconducting materials, the technology could lead to thinner, cheaper and more efficient solar cells. The new grating design captured a range of wavelengths because of the local optical resonances, causing light to spend more time inside the material until it gets absorbed. Because the composite metamaterial collected light from many angles, it would be useful in dealing with sunlight, which hits solar cells at different angles as the sun moves from east to west throughout the day.

Although solar energy conversion is the first application that occurred to Aydin, he said that the new material could be used in other areas.

"Plasmonic and nano-/microwire-based solar cells are receiving lots of attention … and these approaches are all based on the idea that shaping the materials (semiconductors, metals and/or dielectrics) could yield increased absorption and therefore increase efficiency," he said. "Our design offers a much broader, polarization-independent and relatively angle-insensitive response. We also believe that the design of ultrathin absorbers could have implications in defense applications, as they could be used to protect vehicles/planes from the penetration of electromagnetic radiation."

The researchers hope to prove that they can better the absorption in semiconductors.

Findings from the study appeared Nov. 1, 2011, in *Nature Communications* (doi: 10.1038/ncomms1528).