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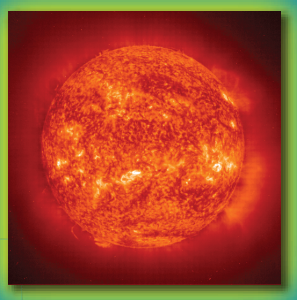
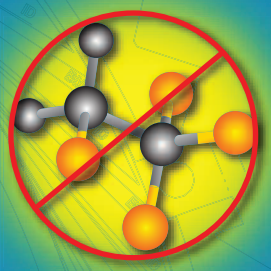
CLIMATE AND THE ADVANCED PHOTON SOURCE

Increased reliance on solar energy would reduce consumption of fossil fuels and limit climate-changing gases. Use of silicon-based solar cells will accelerate when manufacturers can reduce costs while working around the shortage of high-quality silicon. Research at the Advanced Photon Source (APS) at Argonne, and the Advanced Light Source at Lawrence Berkeley National Laboratory (both of which are U.S. Department of Energy laboratories) has shown that an inexpensive form of silicon has potential as a component of commercially viable solar cells.



Amid growing awareness of climate change as a concern in need of rapid solutions, researchers from the U.S. Department of Energy's Argonne and Ames national laboratories, and the University of Iowa, are using the APS to learn more about the functioning of magnetocaloric materials. These have potential for wide application in, among other things, environmentally friendly magnetic refrigeration systems that are not dependent on hydrofluorocarbons (such as tetrafluoroethane, shown in 3-D structure at right), and could reduce the adverse environmental impact of conventional, gas-based refrigeration.



A catalyst that could aid in eliminating nitrogen-oxide emissions from diesel exhausts has been developed by Argonne researchers with the help of the APS. Several companies have expressed interest in licensing and scaling up the technology to bring it to market. The catalyst is one of several that also show promise for reducing nitrogen-oxide emissions from industrial sources such as coal-fired power plants, and refinery and chemical-plant furnaces.

See other side for more information

The Advanced Photon Source at the U.S. Department of Energy's Argonne National Laboratory provides this hemisphere's brightest x-ray beams for research. Scientists and engineers using the APS help assure a bright future for our nation by carrying out research that promises to have far-reaching impact on our technological and economic competitiveness, our health, and our fundamental knowledge of the materials that make up our world.

Argonne is a U.S. Department of Energy laboratory managed by UChicago Argonne, LLC
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For this study, researchers from the University of California, Berkeley; Lawrence Berkeley National Laboratory; GE Energy; the Fraunhofer Institute for Solar Energy Systems; and Argonne used X-ray Operations and Research (XOR) beamline 2-ID-D and XOR/Pacific Northwest Consortium beamline 20-ID-B at the APS, and the 10.3.1 and 10.3.2 beamlines at the Advanced Light Source, Lawrence Berkeley National Laboratory.

See: Tonio Buonassisi[1], Andrei A. Istratov[1], Matthias Heuer[2,3], Matthew A. Marcus[3], Ralf Jonczyk[4], Joerg Isenberg[5], Barry Lai[6], Zhonghou Cai[6], Steven Heald[7], Wilhelm Warta[5], Roland Schindler[5], Gerhard Willeke[5], and Eicke R. Weber[3], "Synchrotron-based Investigations of the Nature and Impact of Iron Contamination in Multicrystalline Silicon Solar Cells," J. Appl. Phys. **97**, 074901 (2005); and Tonio Buonassisi, Andrei A. Istratov, Matthew A. Marcus, Barry Lai, Zhonghou Cai, Steven M. Heald, and Eicke R. Weber, "Engineering Metal-impurity Nanodefects for Low-cost Solar Cells," Nat. Mater. **4**, 676 (2005).

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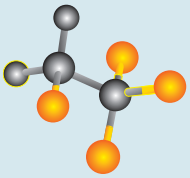
See also: "Making Solar Cells the Quick and Dirty Way," *APS Science 2005*, the annual report of the Advanced Photon Source at Argonne National Laboratory, ANL-05/29, May 2006, p. 40.



This study was carried out by researchers from the Argonne and Ames national laboratories, using the XOR beamline 4-ID-D at the APS.

See: D. Haskel,[1] Y. B. Lee,[2] B. N. Harmon,[2] Z. Islam,[1] J. C. Lang,[1] G. Srajer,[1] Ya. Mudryk,[2] K. A. Gschneidner, Jr.,[2] and V. K. Pecharsky[2], "Role of Ge in Bridging Ferromagnetism in the Giant Magnetocaloric Gd5(Ge1-xSix)4 Alloys," Phys. Rev. Lett. 98, 247205 (2007). DOI: 10.1103/PhysRevLett.98.247205

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See also: "Giant Magnetocaloric Materials Could Have Large Impact on the Environment," http://www.aps.anl.gov/Science/Highlights/2007/20070611.htm

Researchers in this study from Argonne, Aristotle University of Thessaloniki, and the Chemical Process Engineering Research Institute carried out experiments at the Materials Research Collaborative Access Team beamline 10-ID at the APS.

See: V.G. Komvokis,[1] E.F. Iliopoulou,[2] I.A. Vasalos,[2] K.S. Triantafyllidis,[1] C.L. Marshall,[3] "Development of optimized Cu-ZSM-5 deNOx catalytic materials both for HC-SCR applications and as FCC catalytic additives," Applied Catalysis A: General **325**, 345 (2007).

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See also: M.K. Neylon, M.J. Castagnola, N.B. Castagnola, C.L. Marshall, "Coated bifunctional catalysts for NOx SCR with C3H6 Part I: water-enhanced activity," Catalysis Today **96**(1-2), 53 (2004); and M.J. Castagnola, M.K. Neylon, C.L. Marshall, Coated bifunctional catalysts for NOx SCR with C3H6 Part II. In situ spectroscopic characterization," Catalysis Today **96**(1-2), 61 (2004).

And: "New Catalyst Helps Eliminate NOx," http://www.anl.gov/Media_Center/News/2007/CMT070427.html