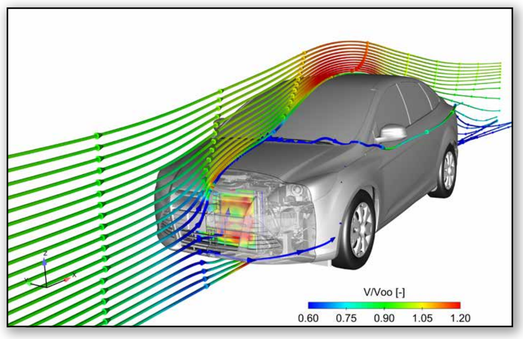
INDUSTRY at National User Facilities

Highlights in Energy

Oak Ridge Leadership Computing Facility



Full vehicle 3D simulation of underhood airflow from computation fluid dynamics calculations.

Ford

Ford uses the high-performance computing resources at the Oak Ridge Leadership Computing Facility to model and optimize the airflow under the hood of automobiles. The work is aimed at increasing the efficiency of engine cooling systems. The computational power available at OLCF reduces the time and cost for evaluating prototype designs.

Advanced Test Reactor

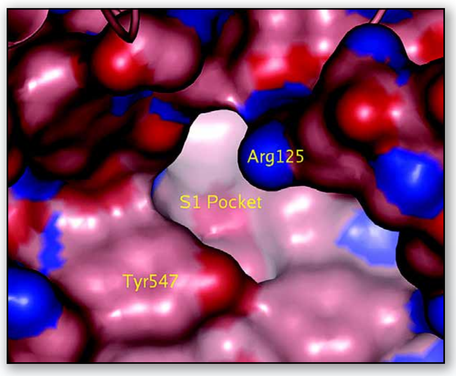
Cells for testing materials at the Advanced Test Reactor

EPRI ELECTRIC POWER RESEARCH INSTITUTE

The Electric Power Research Institute uses the Advanced Test Reactor at Idaho National Laboratory to test materials for nuclear reactors. The experiments characterize corrosion in materials caused by radiation. The results aid the design of new reactors and provide critical data for extending the useable lifetime of existing power stations.

Highlights in Health

Advanced Light Source

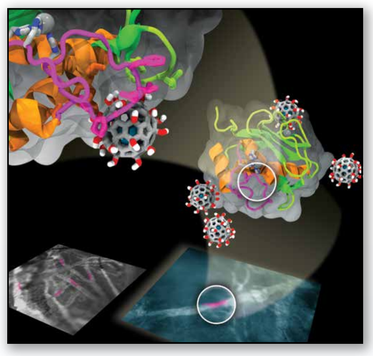


Active site of dipeptidyl peptidase, determined using data acquired at the Advanced Light Source (from *J. Med. Chem.* **2007**, 50, 2297-2300)

Takeda California

Takeda has been using the Advanced Light Source since 2002. In 2013 Nesina was approved by the Food and Drug Administration for the treatment of type 2 diabetes in adults. Nesina is an inhibitor of Dipeptidyl peptidase-4 (DPP4i), a protein that converts GLP-1, a hormone that stimulates insulin production, to an inactive form.

Environmental Molecular Sciences Laboratory



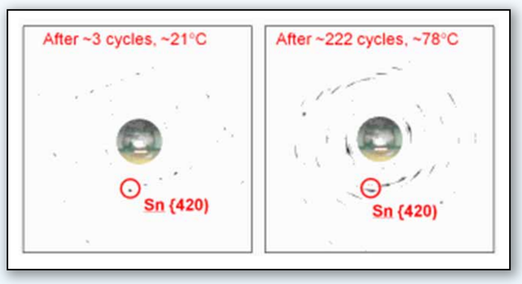
Nanoparticle of $Gd@C_{82}(OH)_{22}$ attacking a tumor cell. The nanomaterial suppresses tumor growth by inhibiting the action of metalloproteinases critical for angiogenesis (growth of blood vessels)

IBM

IBM, working with scientists at the Environmental Molecular Sciences Laboratory, Columbia University and in China, is investigating nanoparticles for the treatment of cancer. These materials, originally developed for medical imaging, inhibit the growth and metastasis of pancreatic tumors.

Highlights in Innovation

Advanced Photon Source

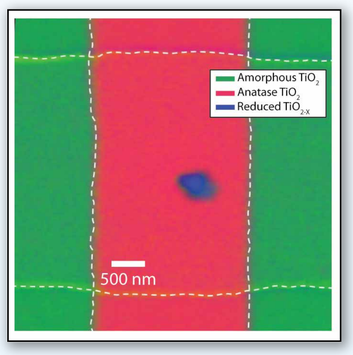


Change in microstructure of lead-free solder joints after thermal cycling. After 220 cycles the diffraction patterns develop streaks, reflecting changes in the structure of the materials used in the joint.

CISCO

Cisco Systems, in collaboration with scientists at Michigan State University and the Max Plank Institute for Iron Research, studied the failure mechanism in lead-free solder joints used in circuit boards. The experiments generated three-dimensional views of the joint and examined how the structure of the material evolved during heat-cycling.

Advanced Light Source

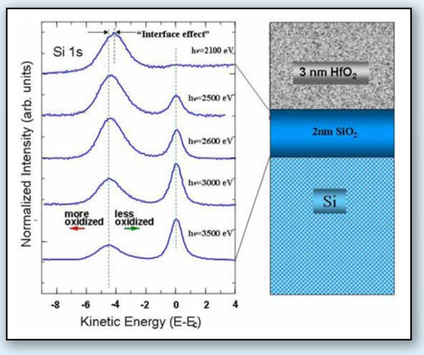


Structure of titanium dioxide, crystallaline and amorphous, within a memristor. Data acquired at ALS beamline 5.3.2

hp

Researchers from Hewlett Packard have employed scanning transmission x-ray microcopy to examine the structure of "memristors" (memory resistors). These electronic components function by changing resistance as current passes through them, a state which is remembered even when power is lost. The memristors offer new possibilities for data memories and for improved efficiency in computing systems.

National Synchrotron Light Source



Depth profiling of layers in CMOS semiconductors using variable kinetic energy-X-ray photoelectron spectroscopy

SEMATECH

Sematech, the consortium of U.S semiconductor manufacturers, uses the National Synchrotron Light Source to examine materials for the next-generation of CMOS semiconductors. The experiments, in collaboration with scientists from the National Institutes of Standards and Technology, yield information on the structure and chemistry of buried layers and interfaces within the semiconductors.

NATIONAL USER FACILITY ORGANIZATION