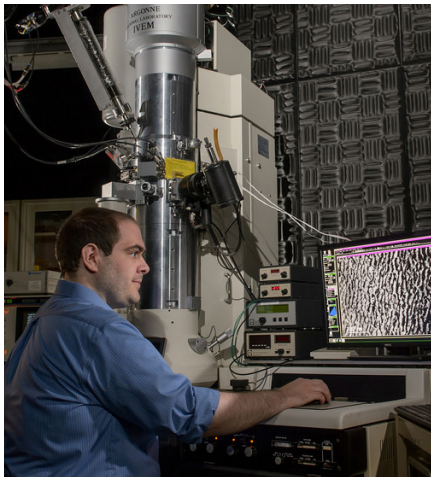
Argonne NATIONAL LABORATORY

R&D FOR NUCLEAR ENERGY MATERIALS

Materials Development Guided by Expertise/Facilities

OVERVIEW

Argonne National Laboratory possesses world-class expertise in fundamental materials and actinide science, which, when combined with strengths in nuclear and chemical engineering enables groundbreaking advances in the development of nuclear energy (NE) materials. The laboratory's materials science research targets enhanced understanding of materials behavior under irradiation and other challenging conditions, development of damage-resistant NE materials, and improved computational modeling of materials behavior.



Chris Ulmer, a graduate student from Penn State University, performs research at Argonne's IVEM facility.

ADVANCED REACTORS

Promising materials are tested under conditions that approximate their operating environments, as well as abnormal conditions, to evaluate and demonstrate their performance and durability. Experimental results are used to test and improve computational models of materials behavior. These computational models and advanced testing capabilities hold great promise for aiding and accelerating the development of high-performance materials for future generation reactors.

LIGHT-WATER REACTORS

The cracking behavior and fracture toughness of activated reactor components are studied in simulated light-water reactor (LWR) environments. Two hot-cell test facilities are used to develop experimental data on the irradiation-assisted stress corrosion cracking (IASCC) susceptibility, fracture toughness, corrosion fatigue, and stress corrosion cracking of stainless steels and their welds.

The laboratory also conducts experimental research to assess and validate models of tube performance in pressurized-water reactor steam generators, as well as to advance non-destructive examination (NDE) techniques. A wide range of NDE technologies have been evaluated for in-service inspection of nuclear power plant components.

IML

Argonne's Irradiated Materials Laboratory (IML) provides capabilities for handling, testing, and analyzing irradiated materials. The IML is used to examine diverse materials issues such as the crack growth rates for LWR internals during long-time operation, the impact on cladding ductility of loss-of-coolant accident (LOCA) conditions, and storage-cask drying for high-burnup fuels.

Four beta-gamma hot cells, two instrumented and shielded glove boxes, and three fume hoods are available to examine, evaluate, and assess materials following exposure to radiation in corrosive environments at elevated temperatures.

IVEM

The Intermediate Voltage Electron Microscopy (IVEM) facility provides the ability to image the changes in the atomic structure of materials undergoing ion irradiation, and is the only one of its kind in the U.S.

ADVANCED PHOTON SOURCE (APS)

Argonne's DOE-SC user facilities are an invaluable resource for nuclear materials R&D. These facilities include the Advanced Photon Source, which provides high-brilliance X-Ray beams and can be used to study radioactive materials that are appropriately shielded and for in-situ studies of materials under controlled conditions of stress, temperature, and in chemically reactive environments.

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U.S. DEPARTMENT OF ENERGY

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