

# The Activated Experiment Encapsulation Laboratory (AXEL)

## Overview

There is a current and growing demand for high-dose material testing of advanced cladding and structural nuclear materials to 100 dpa, 200 dpa, and beyond. This need is driven by both the existing fleet of nuclear power reactors in the United States that require license extensions and the resurging interest in fast reactor concepts. The biggest impediment to meeting this goal is the time required to take fresh material to these high doses, even for Oak Ridge National Laboratory's (ORNL's) High Flux Isotope Reactor (HFIR), which has one of the world's highest fast fluxes. The Activated Experiment Encapsulation Laboratory (AXEL) helps with this problem by allowing for the reencapsulation and reirradiation of existing irradiation specimens—a difficult task due to the high activity associated with these specimens and the need to perform complicated operations to seal and qualify the capsule.

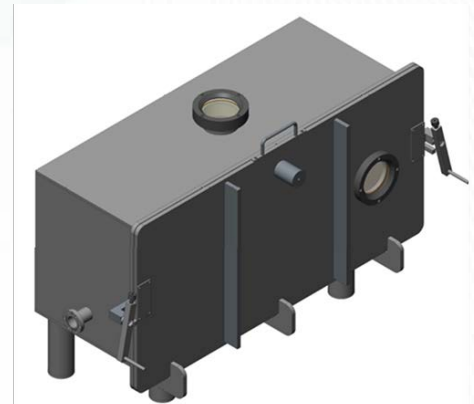
AXEL is a standalone facility located in the Irradiated Materials Examinations and Testing hot cell facility. AXEL is designed to encapsulate or reencapsulate highly activated samples or other target materials into irradiation experiments in a hot cell environment. This new capability enables ORNL to perform unique experiments with HFIR to extend materials irradiation experiments under a wide range of conditions (temperature, neutron dose, etc.).

## Verifying Capsule Quality

AXEL is tooled to assemble the HFIR "rabbit" capsule, which is the workhorse irradiation format for materials in HFIR. Rabbit capsules have a standard aluminum containment that is backfilled with an inert gas and hermetically sealed through various welding operations. Each capsule is subjected to a suite of nondestructive examination (NDE) that includes external hydrostatic compression, helium leak testing, and visual inspection to demonstrate containment integrity. AXEL is fully capable of performing all these tests without taking any special credit for remote handling or other hot cell considerations. Therefore, the AXEL-assembled capsule is built to the same rigor as ones constructed by hand at the bench top.



*Using cameras to aid in positioning the welding torch electrode to perform various capsule welds.*



*The AXEL vacuum chamber: CAD model (top) and internal configuration of the welding equipment (bottom).*

## Contact

**Richard Howard**  
Irradiation Engineering Team  
Oak Ridge National Laboratory  
865.576.4867  
howardrh@ornl.gov

ornl.gov

ORNL is managed by  
UT-Battelle for the  
US Department of Energy

Date: April 2017