NUCLEAR REACTOR LABORATORY

The MIT Nuclear Reactor Laboratory (NRL) (http://nrl.mit.edu) is an interdepartmental center that operates a 6 MW research reactor known as the MITR (MIT Reactor). The NRL has a distinguished history of providing faculty and students from MIT and other institutions with a state-of-the-art neutron source along with a highly efficient, well-organized staff and infrastructure.

The MITR is integrated into the national research and development program as a partner facility of the Department of Energy’s Nuclear Science User Facilities (NSUF). A wide variety of sample irradiation facilities is available in the MITR, with fast (E>0.1 MeV) and thermal neutron fluxes up to 1.3x10^{14} and 5x10^{13} per cm² per second. These include temperature-controlled in-pile facilities, a neutron diffractometer, pneumatic rabbits for short-term irradiations and neutron activation analysis, and other irradiation and beam ports. In-pile loops that closely simulate the environment in light water power reactors are available for corrosion and irradiation damage testing. An in-pile high-temperature irradiation facility for advanced materials studies has been successfully demonstrated to operate up to 1400 °C, and is routinely used up to 850 °C for material testing and qualification of advanced in-core instrumentation.

Other experimental facilities and instrumentation include: radiochemistry laboratories, hot cells for dismantling experiments or testing irradiated materials, radiation detection equipment, and neutron activation analysis facilities. A materials characterization laboratory, established in cooperation with the Nuclear Science and Engineering Department, includes sample preparation equipment, optical and scanning electron microscopes, an Instron mechanical test system and other instrumentation.

Currently, one of the major research areas at the reactor involves in-core irradiations to support materials and fuel development for existing and next generation power reactors. Accident tolerant fuel development for light water reactors and material behavior and tritium transport studies for fluoride-salt-cooled, high-temperature reactors are the subjects of extensive irradiation programs. Other research areas include in-core sensor development and testing, and advanced fuel irradiation testing. The NRL is a major contributor to the US program to convert high performance research and test reactors from high enriched (HEU) to low enriched (LEU) fuel. The Center for Reactor Instrumentation and Sensor Physics was recently established as a joint project of the Idaho National Laboratory and the NRL with the overall goal of advancing instrumentation and automation in nuclear systems.

Undergraduates can be involved in the operation of the reactor by completing the reactor operator training program, which can lead to being employed part-time by the NRL as an NRC-licensed reactor operator. They can also participate in reactor research activities through the Undergraduate Research Opportunities Program (UROP) (http://catalog.mit.edu/mit/undergraduate-education/academic-research-options/undergraduate-research-opportunities-program) or through special projects or senior theses. In addition, graduate thesis research can be carried out in the various research areas mentioned above.