NUCLEAR REACTOR LABORATORY

The MIT Nuclear Reactor Laboratory (NRL) ([http://nrl.mit.edu](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 \(1.3 \times 10^{14}\) and \(5 \times 10^{13}\) per cm\(^2\) 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.

Other experimental facilities and instrumentation include radiochemistry laboratories; hot cells for dismantling or testing; a shielded hot box for handling and nondestructive testing of radioactive materials; radiation detection equipment; delayed and prompt gamma activation analysis facilities; an inductively coupled plasma spectrometer (ICP-OES); and a materials characterization laboratory. A thermal hydraulic lab was established with the Nuclear Science and Engineering Department to study heat transfer properties of nanofluids for nuclear reactor and other thermal management applications.

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 active research areas are in-core sensor development and testing, advanced fuel irradiation testing, neutron optics and nuclear trace analysis application to nutritional studies and other life science, geoscience, environmental and nuclear engineering problems. The NRL is also involved in the development of compact, high-intensity, X-ray light sources.

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, and/or utilize the reactor in research activities through special projects or senior theses. In addition, graduate thesis research can be carried out in the various research areas mentioned above.