Canadian Nuclear Laboratories | Laboratoires Nucléaires Canadiens

High Temperature Fuel Channel Laboratory

CNL's High Temperature Fuel Channel Laboratory (HTFCL) is located at the Chalk River Laboratories in Chalk River, Ontario. With over 100 experiments successfully designed and performed, the HTFCL has a great deal of experience within the fuel channel field of study. It is an experimental facility used to provide data to characterize fuel channel behaviour under accident scenarios.

Many experiments in the HTFCL use full-diameter sections of fuel channels to observe how they deform under pressure and behave at high temperatures. Smaller-scale experiments include studies of fuel channel behaviour using a small diameter supercritical water apparatus that operates at 25 MPa and 600°C. The results of these tests help to understand the unique thermal behaviour of materials being considered for insulating fuel channels in future reactor designs, such as the Generation-IV Canadian Supercritical Water Reactor design. Other smaller scale experiments performed in the HTFCL are focused on obtaining high-temperature material properties.

Positioned over two floors, a unique feature of the HTFCL is the test enclosure area, or "test cell". Given that the purpose of the experiments is often to test the fundamental behaviour of components under high temperature and pressure conditions, often to failure, the test cell is designed to contain any pressure pulses and projectiles in the event of a test section rupture. The test cell can be used to run experiments in a gas environment as high as 20 MPa, and low pressure steam experiments with discharge temperatures as high as 1,200°C. Experiments in the HTFCL are routinely conducted utilizing conditions as high as 14 MPa and greater than 1,000°C. To conduct these experiments, the HTFCL is equipped with a 500 kW power supply, and high-pressure gas and steam supply systems. The lab's control room has the equipment necessary to remotely monitor and manage the experiments within the test cell.

The High Temperature Fuel Channel Laboratory is interested in cultivating partnerships which involve high temperature heat transfer experiments, or include studies of micro-structural and phase transformations and their relationship to high-temperature deformation behaviour of nuclear materials.

HTFCL Staff Capabilities:

- Experience in apparatus design for high temperatures and pressures, high temperature measurement techniques, electrical heater design (e.g., fuel element simulators), and high-temperature materials behaviour
- Knowledge in both experimentation and computation for heat transfer, thermalhydraulics and materials behaviour
- Understanding of reactor safety analysis for postulated accident scenarios in existing reactors and for evaluations of future reactor safety requirements