

Reactor Materials Testing Laboratory

Summary

The Reactor Materials Testing Laboratory (RMTL) is an exciting research endeavor for the Queen's **Nuclear Materials Group**. It uses a proton accelerator, similar to those found in many universities and hospitals throughout Canada, to introduce damage into materials at a microscopic scale. By studying the effects of this damage on the way that materials behave we can gain insight into, and draw parallels with, the way that materials are damaged within a nuclear reactor. The facility has been funded with a grant from CFI/MEDT.

The RMTL project was conceived by **Prof. Rick Holt**, then the NSERC **Industrial Research Chair in Nuclear Materials**. Now an Emeritus Professor at Queen's, Holt continues to take a major role in the realisation and implementation of the RMTL; the building is presently in the final stages of construction with the accelerator installed in late 2013. The new project lead is **Prof. Mark Daymond**, who became the NSERC Industrial Research Chair in Nuclear Materials in the spring of 2012.

Details

There is presently a world-wide resurgence of investment in nuclear power. This has partly come from a desire to operate existing reactors beyond their originally planned lifetime, but is also combined with a realization that nuclear power must be a major component of power generation infrastructure over the next 50 years and beyond if countries wish to maintain low carbon emissions. Correspondingly, there is a renewed interest in research within the area of structural materials for nuclear power applications.

Materials behave quite differently in a nuclear power reactor environment than in conventional applications. The differences are due to the damage to the atomic structure of the materials caused by fast particles; in a reactor these particles are the neutrons that allow the nuclear reaction to occur.

The RMTL will investigate these materials' issues using a different approach, based on the use of accelerator technology. By accelerating protons to moderately high energies, we will be able to introduce damage into small pieces of material. This will simulate the effects occurring within a reactor, allowing us to investigate the way that materials respond to stress and temperature. The goal is to develop a better understanding of the way that materials operate in a reactor, leading to the safe, long-term running of reactors. The laboratory also includes a state-of-the-art electron microscopy suite (SEM, TEM) for characterisation of the materials that have been in the accelerator..

Similar accelerators are quite common; they are found in universities throughout Ontario and the rest of Canada for the study of, for example, semi-conductor technology; and in hospitals for the treatment of patients.

If you would like more information about this research effort, please **download** this information sheet, or contact **Rick Holt** or **Mark Daymond**.

See some pictures of the construction of the building here: **May 2012**; **October 2012**; **April 2013**; **July 2013 - external**; **July 2013 - accelerator hall**.

Picture of a functioning accelerator of similar design at Uppsala University in Sweden:



The Queen's RMTL accelerator as it is first being installed:



Prof. Holt, and a view of the inside of the accelerator



The new building

