Materials in Radiation Environment Beamline Project

Nuclear energy plays an important role in providing reliable, carbon-free electricity at home and around the world. To sustain the current aging fleet of US nuclear power plants and support the development of new advanced nuclear reactors, there is a need for new insights into how materials perform under operating conditions. Complementing investments in existing and planned world-leading facilities at Idaho National Laboratory (INL), the nuclear materials community needs dedicated access to a synchrotron facility to study and improve the performance of materials under conditions encountered in nuclear reactors. Synchrotron x-ray-based techniques provide information on material chemistry, structure and 3D geometry that cannot be obtained by any other method. In addition, synchrotron x-ray-based techniques provide insights on how these characteristics change in real time as materials can be tested under a range of conditions at the beamline. Understanding and applying the principles that control material performance is key to the Nation's need to sustain existing nuclear energy infrastructure and develop and deploy the next generation of nuclear power technologies.

> ***"Our collaboration with the National Synchrotron Light Source II has helped understand how protective films develop and function on engineering alloys being evaluated for accident tolerant nuclear fuel cladding. These advancements are crucial for designing safer reactors to produce clean energy for the community at large."***
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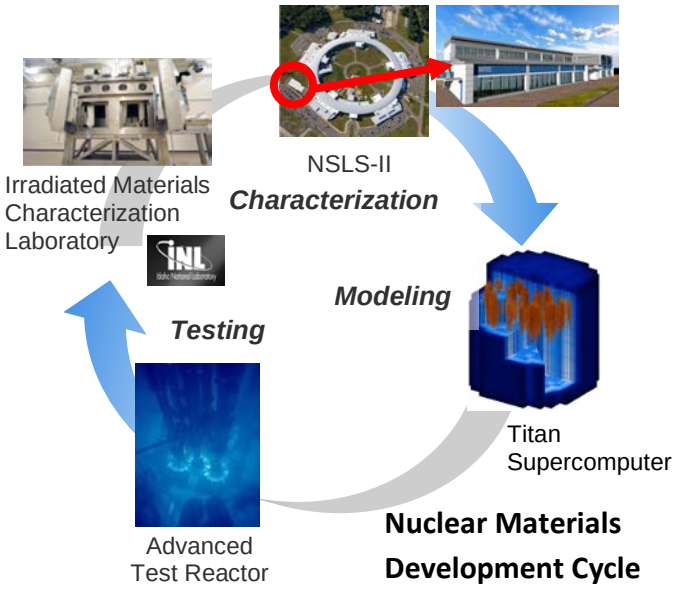
> **Raul Rebak**, GE Global Research



The National Synchrotron Light Source-II (NSLS-II) at Brookhaven National Laboratory is the most advanced synchrotron in the world and is ideally configured to build a dedicated facility for the nuclear materials community. This concept, referred to as the Materials in Radiation Environment (MRE) beamline, combines the world-leading materials research capability of the NSLS-II and a shielded facility for handling radioactive materials. The MRE beamline will be a secure satellite building connected to the NSLS-II via a vacuum pipe that allows for the delivery of an intense beam of x-rays.

As a separate new building with the capability to handle larger irradiated samples, researchers will be able to complete experiments that cannot be performed at existing synchrotrons and gain insights that will provide the US with a competitive advantage. In coordination with INL's specialized facilities and leveraging its foremost sample preparation expertise, the MRE beamline will be an integral part of the Nation's nuclear materials development cycle, which supports nuclear fuel development, evaluating nuclear fuel performance, determining the effects of operating conditions on cladding and other materials used in existing and advanced reactors, and characterizing nuclear waste forms. Researchers at academic institutions, industry and federal research laboratories will have access to the MRE beamline.