Contribution ID: **43** Type: **not specified**

Post irradiation examination and lifetime limits of highly irradiated components at the Spallation Neutron Source and High Flux Isotope Reactor

Thursday, 31 October 2024 13:40 (25 minutes)

The microstructure and mechanical properties of components in high-dose environments are altered during operation, which typically result in a loss of ductility and fracture toughness. The decrease in ductility limits the useful component lifetime due to concerns of fracture during operation. The useful lifetimes of components are established by reviewing previous results from characterizations of a particular alloy and selecting dose values that limit the risk of failure; however, test results for materials and irradiation environments under consideration are not always available. The most desirable information for establishing lifetime limits are results from testing material samples from actual components after operation. Post irradiation examination (PIE) of components after removal from service provides the most accurate information on radiation-induced changes in material properties. A PIE program is maintained at the Spallation Neutron Source (SNS) for targets and proton beam windows to ensure the administrative lifetime limits are optimized to provide reliable operation. Material samples form targets and proton beam windows are routinely obtained and characterized to measure the radiation-induced changes to mechanical properties. Another PIE project at Oak Ridge National Laboratory (ORNL) is focused on sampling a section of a 6061-T6 aluminum beam tube that was installed and operated in the High Flux Isotope Reactor (HFIR) for 25 years. During this presentation the various current PIE projects at ORNL will be described, followed by a discussion on how the results are used to establish administrative dose limits and limit the risk of component failure.

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Session Classification: Results from Post-Irradiation Examination of target and structural materials, innovative experimental techniques in study of irradiated materials

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