Qualifying Irradiated Structural Austenitic Stainless Steels for Kairos Power's Fluoride-Salt-Cooled, High-Temperature Reactor

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Kairos Power's fluoride-salt-cooled, high-temperature reactor (KP-FHR) technology uses a novel combination of existing technologies to achieve unique levels of economy, safety, flexibility, modularity and security for nuclear power production. In particular, it relies on 316H austenitic stainless steel for structural components of its core, such as the core barrel and reactor vessel. This talk will present the ongoing efforts aiming at qualifying KP-FHR structural 316H stainless steel components with a focus on irradiation effects. These efforts leverage the significant amount of irradiation test data for austenitic stainless steels that has been generated in the past 50 years. Relevant irradiation and test conditions for KP-FHR include temperatures from approximately 550 to 650°C, low levels of stresses, and low doses and dose rates for most 316H stainless steel components as a result of shielding. The talk will present the identified gaps in the available data, in particular related to the performance of austenitic stainless steel undergoing long-term thermal aging combined with very low dose rates. Strategies to address those gaps with additional neutron irradiation and post-irradiation examination and testing will be presented.