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Code Qualification Plan for an Advanced Austenitic Stainless Steel, Alloy 709, for Sodium Fast Reactor Structural Applications

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Sodium Fast Reactor (SFR) is one of the leading advanced reactor concepts that would provide a low-carbon energy option to a diverse U.S. power sources. Nuclear energy releases zero carbon emissions during electricity production, and thus is essential in reducing CO2 emissions from the U.S. power sector. SFR also supports other possible missions, including recycling of used fuel for closing the fuel cycle.
Improved structural material performance is one way to improve the economics of SFRs; by increasing thermal efficiency, power output, and design lifetimes of the reactor system. Improved performance and reliability of structural materials could also enable greater safety margins and more stable performance over longer times, and reduce down time of the reactor plant. Advanced materials could also spur improvements in high temperature design methodologies and thereby allowing design simplifications and more flexibility in plant operations. Thus, they could have a significant, positive impact on levelized electricity production cost even if the commodity costs for the advanced materials are higher. Capital cost reduction and improvement in economic return are important incentives for commercial deployments of SFRs.
Alloy 709 is an advanced austenitic stainless steel with enhanced creep strength relative to Code-approved reference construction materials (Type 304 and 316 stainless steels) and that makes it an attractive candidate material for SFR structural applications.
In this paper, some preliminary data for Alloy 709 will be presented and a qualification plan for developing an ASME nuclear code case will be reviewed.

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