Irradiation Performance Testing of Specimens Produced by Commercially Available Additive Manufacturing Techniques

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ABSTRACT:

The proposed project will collect first-ever irradiation performance data for stainless steel and Inconel specimens produced using a range of commercially available additive manufacturing techniques. Commercial suppliers will produce a set of standardized tensile bar specimens using a representative range of currently-available additive manufacturing techniques and parameters. The Colorado School of Mines will conduct pre-irradiation thermo-mechanical testing (tensile strength, yield strength, elastic modulus, ductility, thermal conductivity and thermal diffusivity) and micro-structural characterization of the specimens at the University's facilities. A subset of the tensile bar specimens will be irradiated to a range of fast neutron fluences at typical light water reactor temperatures (~600 K) in the Advanced Test Reactor (ATR). Thermo-mechanical testing and micro-structural characterization of the irradiated specimens will be conducted at the Advanced Test Reactor National Scientific User Facility (ATR-NSUF) post-irradiation examination facilities. The remaining un-irradiated specimens will be thermally aged at the University and subjected to post-aging thermo-mechanical testing and micro-structural characterization. In addition to the required progress and final reports, the project will produce two archival journal articles and two conference papers describing the results of the test campaign. A comparison of the physical properties and microstructure of the irradiated specimens to those of the as-fabricated and thermally-aged specimens will provide insight into the viability of additively manufactured parts for nuclear reactor applications, identify key areas of concerns for further technology development efforts, and provide data for future computational model development.