

NE-18-16167, Development and Testing of Alumina-forming Austenitic Stainless Steels for Lead Fast Reactor Application

For the nuclear industry and Westinghouse Electric Company (Westinghouse) in particular, an alumina-forming austenitic alloy optimized for a lead fast reactor application would eliminate a key technical challenge (the corrosive nature of liquid lead at high temperature). This same barrier is also limiting the feasibility of proposed concentrated solar energy projects. Alumina-forming austenitic steels have been developed by Oak Ridge National Laboratory (ORNL) for high-temperature applications in other environments, showing very promising high-temperature performance.

Utilization of alumina-forming austenitic steels is a key enabler to the Westinghouse lead fast reactor for developing favorable economic attributes and achieving competitiveness with natural gas power plants. The ability to operate at temperatures higher than current lead fast reactor concepts would permit the Westinghouse lead fast reactor to most effectively implement a heat storage system for non-reactor-based load following operation (envisioned for renewables complementation) and address non-electricity applications such as process heat generation.

ORNL will work with Westinghouse to optimize alumina-forming austenitic steels for applications specific to lead fast reactors, as reliable materials for key components such as fuel rod cladding, heat exchangers, reactor internals and the reactor vessel. ORNL will then conduct testing in liquid lead. The work will inform lead fast reactor materials selection. The availability of evidence supporting the high-temperature operation scenario for lead fast reactors will reduce business uncertainties and development risk, increase confidence, and accelerate timelines for achieving targeted economic performance.