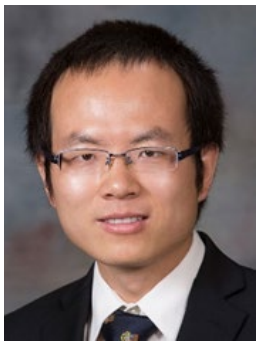
NEBRASKA CENTER FOR ENERGY SCIENCES RESEARCH

Cycle 19
January 2025



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Advanced manufacturing of high-temperature alloy components for small modular reactors

Abstract.
Compared to the traditional full-scale nuclear energy plants, small modular reactors (SMRs) have advantages such as smaller physical footprints, reduced capital investment, and ability to be sited in locations inappropriate for larger nuclear plants. In addition to generation of electricity for Nebraskans, SMRs may create new economic opportunities for Nebraska such as the nuclear-powered data centers and agricultural wastewater treatment plants.

This project aims to enable advanced manufacturing of high-temperature alloy components in Nebraska for SMRs. It will develop novel additive manufacturing (AM) technologies for advanced austenitic steels, which are candidate materials for components of high-temperature SMRs. AM can produce small, high value components, which has the potential to reduce the deployment time and component fabrication costs of SMRs.

The scientific hypothesis is that mechanical properties of additive manufactured structural alloys, particularly the ductility and creep deformation, are controlled by defects. The key innovations include: 1) understanding the relationship between processing and defects; 2) interpreting the relation between microstructures and high-temperature mechanical properties; and 3) scaling-up the AM process to produce the specific components for SMR. We will collaborate with external partners in national laboratories and nuclear industry to understand the scientific mechanisms, evaluate the performance of additive manufactured materials, and scale up the manufacturing process.