# High Throughput Material Characterizations and Irradiation Capabilities for the Development of High Entropy Alloys in Nuclear Application

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**Program**: General Scientific Infrastructure for Consolidated Innovative Nuclear Research

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**ABSTRACT:**

The University of Wisconsin-Madison (UW) Nuclear Engineering program has unique strength in experimental programs to develop nuclear technology, currently performing advanced nuclear research in support of multiple advanced concepts, including high-temperature gas-cooled reactors, fluoride salt-cooled reactors, and sodium-cooled fast reactors, as well as constantly supporting the research and development of current LWR's technologies.

The University of Wisconsin-Madison (UW) Nuclear Engineering faculty are currently focusing on the development of high entropy alloys (HEAs) for various applications in nuclear energy using high throughput manufacturing methods; additive manufacturing and combinatorial thin films. Although those techniques may provide large compositional space of HEAs, they can be only fully utilized if accompanied by high-speed material characterization and irradiation methods. The proposed infrastructure project has two key components, which aim at developing new high throughput capabilities for the entire nuclear materials' community, through NSUF access:

1. Develop automated high-speed and high-volume surface imaging and chemical analysis capabilities for additively manufacturing HEAs. This infrastructure will significantly augment the existing 3D printing capabilities, allow exploration of various alloy compositions and allow characterization of a high volume of irradiated samples.

2. Develop high throughput irradiation capabilities for additively manufactured and combinatorial thin films of HEAs. These capabilities will be installed in the University of Wisconsin Ion Beam Laboratory, NSUF partner facility. Therefore, this unique setup will be available for the NSUF scientific community.

The addition of the above capabilities will complement the University of Wisconsin's high throughput HEA manufacturing capabilities with high speed/high volume material characterization and ion irradiation tools, which will accelerate the development and implementation of HEAs in nuclear applications.