

NE-21-25980, Development of Casting Techniques for δ -phase Uranium-Zirconium Alloys

Lightbridge Corporation, based in Reston, Virginia, is a nuclear fuel technology development company. Their mission is “to develop innovative next generation nuclear fuel technologies for current and future reactors, which significantly enhance the economics and safety of nuclear power.”

To melt cast δ -phase U-Zr alloys, as compared to unalloyed and lightly alloyed uranium, requires higher temperatures. Because carbon content increases as a function of casting temperature and crucible coating, this increases the likelihood of a detrimental reaction between the alloy melt and crucible material. Currently, there are temperature limitations with graphite and quartz crucibles. As a result, the microstructural stability of the alloy can be compromised. The casting, processing, and shipping of HALEU alloys, like those being developed by Lightbridge, require the ability to experiment with higher temperatures in a facility that can perform these functions.

The objective of this project is to determine the optimal casting process for the Lightbridge δ -phase U-Zr alloy using a depleted uranium (DU) zirconium surrogate in the Radiochemical Processing Laboratory (RPL) which is located at the Pacific Northwest National Laboratory (PNNL). PNNL brings expertise in developing processes for advanced uranium alloy casting and is the fabrication lead for the U.S. High Performance Research Reactor (HPRR).