NuVision
partnered with
Oak Ridge National Laboratory

RFA-17-14621, Evaluation of Power Fluidic Pumping Technology for Molten Salt Reactor Applications

YEAR AWARDED: 2017

TOTAL PROJECT VALUE: $219k (DOE Funds Awarded: $175k; Awardee Cost Share: $44K)

STATUS: Completed

PRINCIPAL LAB INVESTIGATORS: Kevin Robb (robbkr@ornl.gov)

DESCRIPTION: Power Fluidics™ (PF) is a NuVision Engineering proprietary technology which uses gases, usually air, to control the flow of other fluids in industrial applications. Molten salt nuclear reactors and associated systems have unique fluid handling requirements. This unique technology has several advantages over traditional centrifugal pumps. Due to its lack of energized components and moving parts, it is especially suited for pumping and mixing liquids in hazardous or safety-related applications (e.g., in nuclear process plants or waste tanks). NuVision has developed and deployed different configurations of the PF technology in the form of pulse jet mixers, pumps, and single point fluid samplers. With support from a GAIN voucher, researchers at Oak Ridge National Laboratory helped NuVision explore the applicability of PF to molten salt systems.

BENEFIT: Multiple prospective reactor vendors have indicated that their preferred method for creating reactor fuel for their initial fuel salt loads is to incorporate the remaining fissile materials from used light water reactor fuel into a fuel salt. Used LWR fuel is highly radioactive, necessitating remote handling and providing strong incentive for highly reliable components. Moltex Energy, Terrestrial Energy, and Elysium Industries have referenced salt based LWR fuel processing methods to prepare new fuel for their reactor design. Additionally, both Muons Inc. and Elysium Industries have received GAIN vouchers from the US Department of Energy to evaluate and/or demonstrate the technology to convert used LWR fuel to MSR fuel salt. Metatomic was formed to commercialize the conversion of used LWR fuel into MSR fuel salt. While some of the envisioned processes begin with dry head end processes, all of the envisioned systems require pumping controlled amounts of highly radioactive, corrosive fluids for which fluidic pumps would be a preferred technology.

IMPACT: With the recent resurgence in molten salt R&D, the supply chain for high-temperature molten salt pumps is currently a challenge. PF technology may be able to fulfill some of the forced-flow testing required in support of MSR R&D.

NEXT STEPS: MSR-tailored PF technology would have wide applicability in plant and fuel cycle operations. However, the MSR customized version of the technology does not yet exist and would be necessary to address the specific technical issues for MSR deployment. Additionally, MSR developers are not generally aware of the capabilities of PF and are consequently not including PF in their designs. Developing and demonstrating a molten salt customized version of a PF-based pumping system is recommended to introduce the technology to potential customers and regulators.