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Grantee: University of Michigan
Title of Grant: High Fidelity Modeling and Experiments to Inform Safety Analysis Codes for Heat Pipe Microreactors
Period of Performance: 11/30/2020-11/29/2023 (FY20 Notice of Funding Opportunity NOFO)

Executive Summary

In 2018, the Nuclear Energy Institute has issued a road-map for the development of Microreactors for deployment by the U.S Department of Defense (DoD). A critical point for a timely deployment is associated to the licensing process with U.S. NRC. This requires the development of accurate heat pipe simulation capabilities. The present proposal addresses the modeling challenges associated with the licensing of heat pipe microreactors by establishing a unique, high-resolution experimental database on sodium heat pipes behavior during stationary and transient conditions, including abnormal operation and close to thermal limits, leveraging the advanced experimental capabilities available at the University of Michigan; b) by complementing the experimental activity with high-fidelity Computational Fluid Dynamic (CFD) simulations to inform the development of Reduce Order Models (ROMs) for 1D thermal-hydraulic codes. The developed ROMs will enable best-estimate system code to correctly capture the thermal-hydraulic behavior of liquid metal heat pipes; c) by demonstrating the developed ROM in the BlueCRAB suite, including validation.

Benefits. The proposed work will advance the understanding of heat pipe behavior close to their thermal limits, will provide unique experimental data for model validation and will support the advancement of best-estimate analysis codes needed to perform safety analyses of heat pipe microreactors.

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Presentations and Publications

The list of publications was submitted with the final report after grant expiration.

Bourdot Dutra, C. D. S., Merzari, E., Acierno, J., Kraus, A., Manera, A., Petrov, V., ... & Shaver, D. (2023). High-Fidelity Modeling and Experiments to Inform Safety Analysis Codes for Heat Pipe Microreactors. *Nuclear Technology*, 1-25, 2023.

Patents

N/A