
Project Title

A Dedicated Facility for Direct Visualization of Bubble Dynamics in Molten Salts

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Program: General Scientific Infrastructure
(GSI) Support for Universities

ABSTRACT:

The project aims to establish a state-of-the-art facility for high resolution imaging of bubble dynamics in molten salts. The need for this infrastructure stems from the collaboration of the University of Puerto Rico (UPR) and Sandia National Laboratories (SNL); which identified the national lack of capability to conduct experiments in a dedicated facility for visualization of bubble dynamics in molten salts.

Specifically, the equipment has been engineered to provide a uninterrupted viewing section of 60 cm² of molten salt that can be controllably heated up to 1000 °C. Bubbles will be either externally supplied or generated by vaporization with point heaters, and will have controlled size. It will be able to operate with a variety of molten salt mixtures, including 2LiF-BeF₂. High-speed and high-resolution imaging will be collected to characterize bubble rising and bursting after arriving to a free surface. A combination of (i) high power continuous and pulsed lasers synchronized with (i) a shadow strobe and (iii) high-speed cameras will be available in the facility, in order to be able to design experiments to visualize aerosol particles generated during the bursting process. Moreover, cascade impactors will be used to characterize aerosol particles.

With this facility it will be possible to correlate bubbles (i) size, (ii) dynamics, (iii) terminal velocity, (iv) temperature, (v) environmental pressure and composition and (vi) molten salt type (of different surface tensions) with the final aerosolization outcome.

The research outcome from this facility will provide needed information for use in modelling and experimental aspects of the design of molten salt reactors. Our particular global aim is to reduce the technical risk involving bubble presence in molten salt nuclear reactors and contribute to improved design concepts.

Since, to the best of our knowledge, this facility would be unique with dedicated capability to conduct this type of experiments, it will be willingly able to become a NSUF partner.