Static Supercooling Study in Fluoride Salt Mixtures

L. J. Chapdelaine, R. O. Scarlat
Department of Engineering Physics, University of Wisconsin - Madison
1500 Engineering Drive, Madison, WI 53706, USA
lchapdelaine@wisc.edu

Abstract

Molten salts offer highly beneficial heat transport properties over the high temperature ranges in which they remain in the liquid phase (450 to 1200 ^{o}C). This high temperature heat transport that is possible with liquid salts has invaluable application in nuclear reactors, chemical processing, and solar thermal plants. Of the various kinds of salts considered for this kind of application, fluoride salts hold particular interest due to outstanding heat conduction and extremely high temperature operating regimes. Their freezing properties and phenomena are being studied in order to predict performance during overcooling transients and to design for recovery from freezing accidents.

The Static Freezing Experiment (SFX) is being conducted in order to investigate the supercooling phenomena observed in freezing 2LiF-BeF_2 salt (FLiBe). FLiBe supercooling has been observed in various freezing situations in previous experiments, but never definitively quantified. Literature about supercooling in other fluids suggests that variables such as cooling rate and sample volume may have a measurable effect on supercooling in FLiBe.

Cooling rate and potentially volume are therefore varied in SFX to determine the quantitative relationship they may have on FLiBe supercooling. The results of this experiment are to be compared with freezing simulation results as part of this study to determine simulation validity as well as to improve the simulation performance for future experiments involving FLiBe flow in a pipe. This experiment is to be conducted with FLiBe as well as its simulant fluids to determine whether simulant fluids can be successfully used to reproduce overcooling transients of FLiBe, at reduced temperatures, reduced scales, and with non-toxic fluids.