UW Flow Loop

- **Parameters:**
  - **550 C – 800 C**
  - **3-5 cm/s flow**
  - **Redox control**
  - **Sample inserts**
  - **Online beryllium additions**
  - **Ability to control cooling**

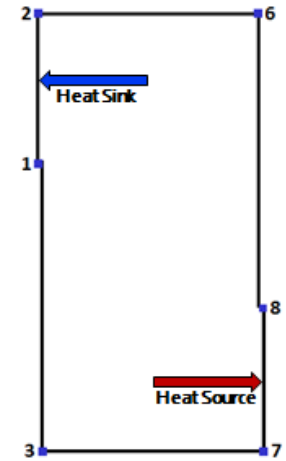
Measurements

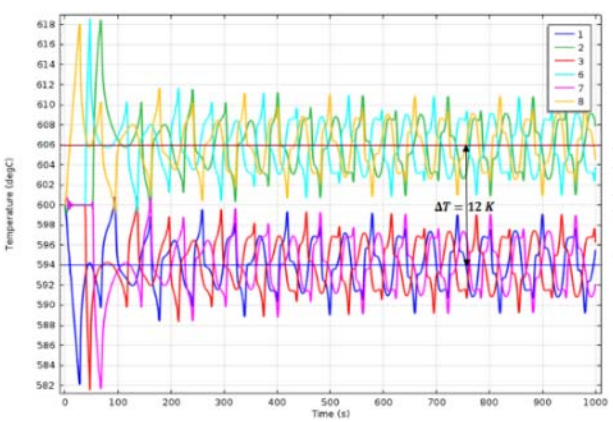
- **Direct**
  - **Temperature**
    - ❖ **Outer Wall**
    - ❖ **Center line**
    - ❖ **Point**
  - **Redox**
  - **Power input**
  - **Cooling fan power**
- **Indirect**
  - **Flow velocity**
  - **Mass Transport**
  - **Heat transfer coefficients**

Natural Circulation Loop Model in COMSOL

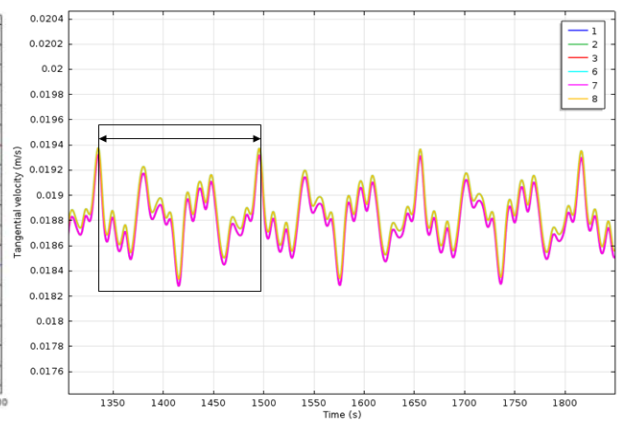
COMSOL Simulations

- **1-D, Transient study**
- **Boundary conditions: uniform heat flux at the cooled and heated regions**
- **System reaches a periodic-steady-state condition**
  - **The period is equal to the time it takes for the salt to complete one loop**
- **Changing the boundary condition at the cooled region to a constant convective boundary condition has an attenuating effect on the cyclic behavior of the flow/temperature in the system**

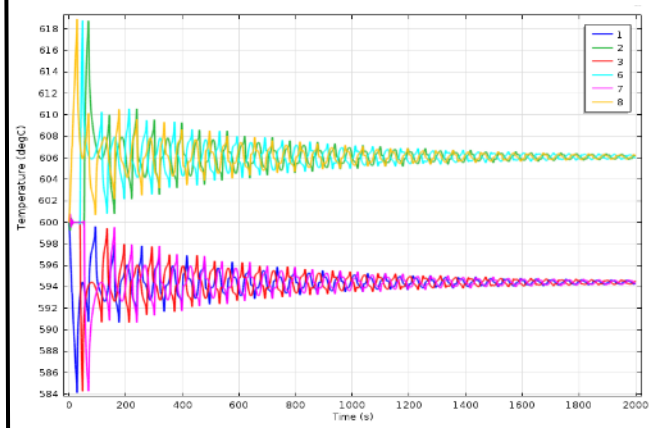




Temperature versus time



Velocity versus time

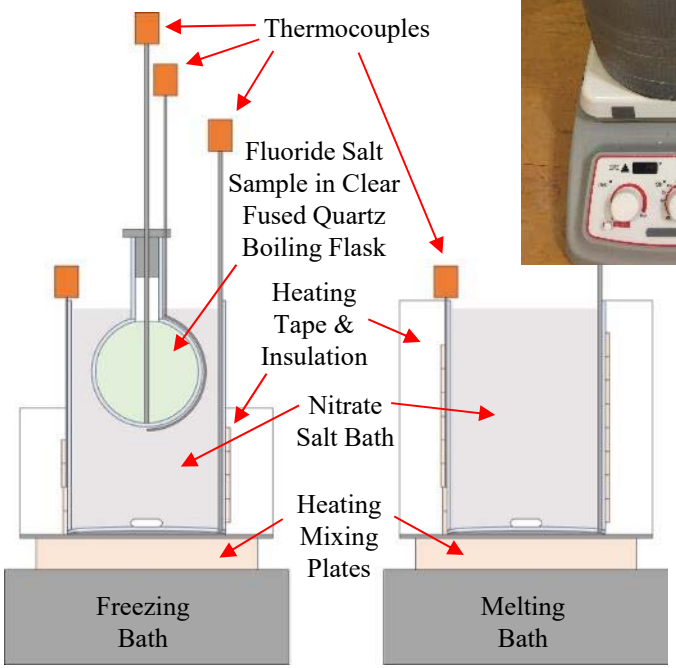


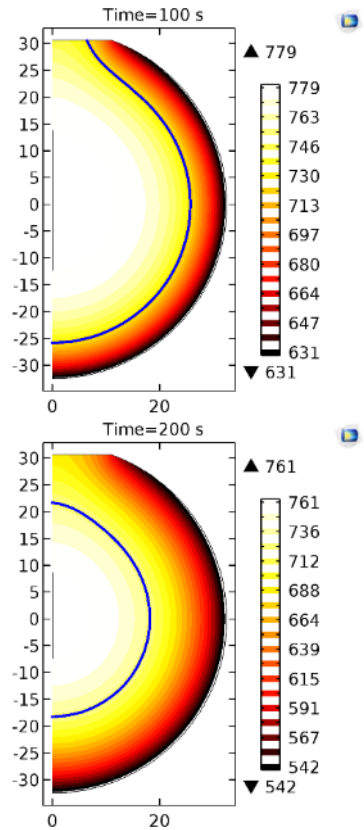
Temperature versus time

Molten Salt Freezing Experiments

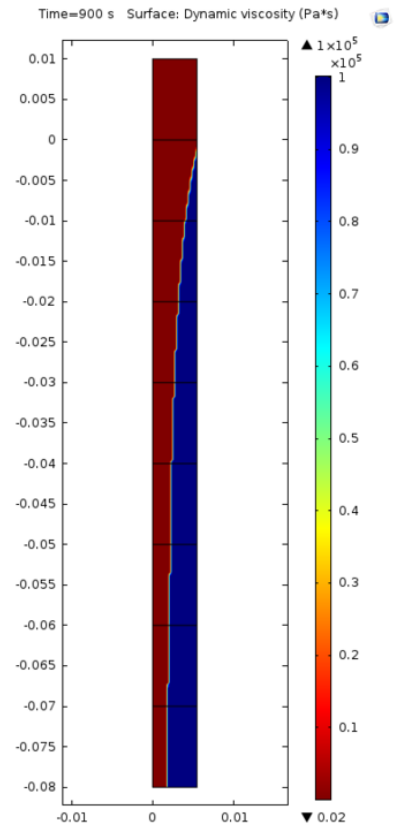
GOAL: Model and experimentally validate freezing front propagation and heat transfer properties in a static molten salt environment, as well as quantify supercooling effect

Static Freezing Experimental Setup:





Static Freezing Experiment Modeling Pre-prediction



Pipe Freezing Experiment Modeling Pre-prediction