ICE SLURRY PRODUCTION IN PLATE HEAT EXCHANGERS WITH SUBCOOLED SCRAPED SURFACE

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Introduction: ice slurry production in the SSPHE

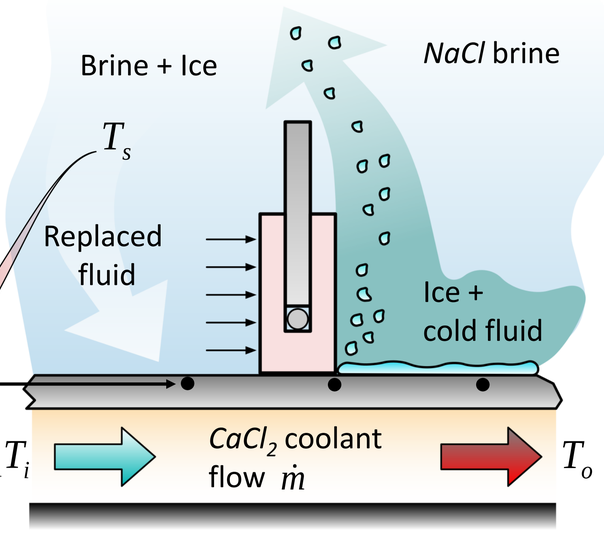
Ice slurries consist of aqueous solutions in which small ice crystals are present. One of the main advantages of ice slurries compared with the storage and usage of common ice is the easiest transport capacity, being possible to pump it. Due to their high cooling capacity and constant cooling temperature, the use as refrigerant offers the major benefit of ice slurries.

In this work ice slurry is produced in an innovative scraped-surface plate heat exchanger (SSPHE): a 28 liters capacity tank with a total heat transfer area of $10 m^2 m^{-3}$ crystallizer volume.

The heat transfer surface is continuously scraped by four rotating blades and cooled underneath by a flow of calcium chloride solution in water. The coolant solution is subsequently cooled by the expansion of a flow of R507 refrigerant in a compact evaporator.

$$h = \frac{q''}{A(T_s - T_w)}$$

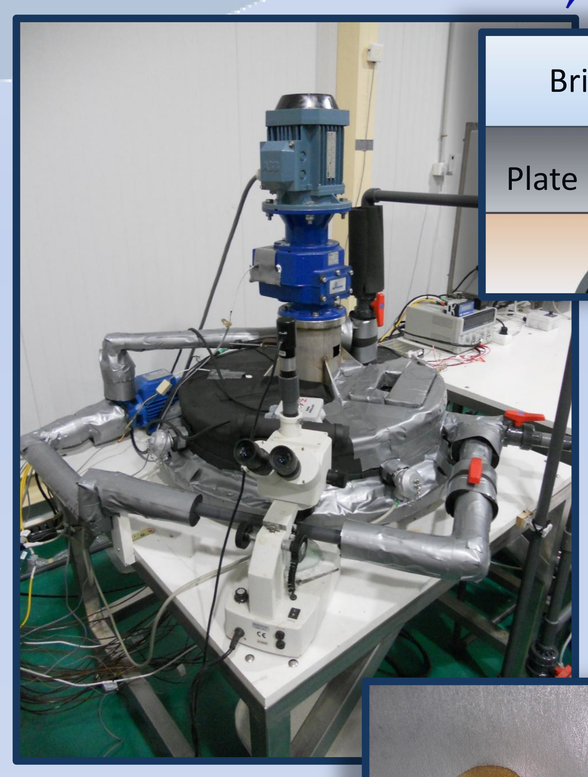
$$q'' = \dot{m} c_p (T_o - T_i)$$

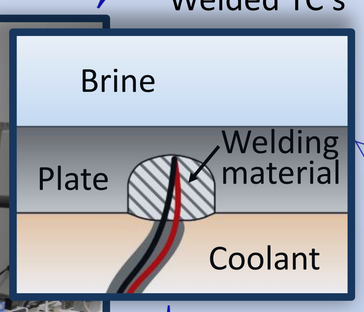


Experimental facility

Base solution: 2 to 10% NaCl in water
Batch process: 20% of ice content

Scraped surface heat exchanger and visualization system





Welded TC's

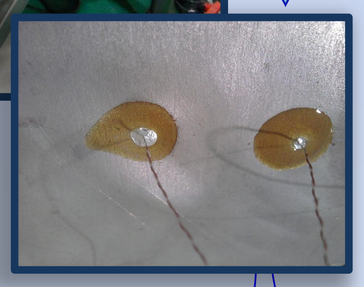
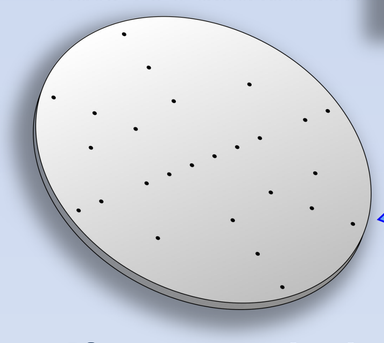
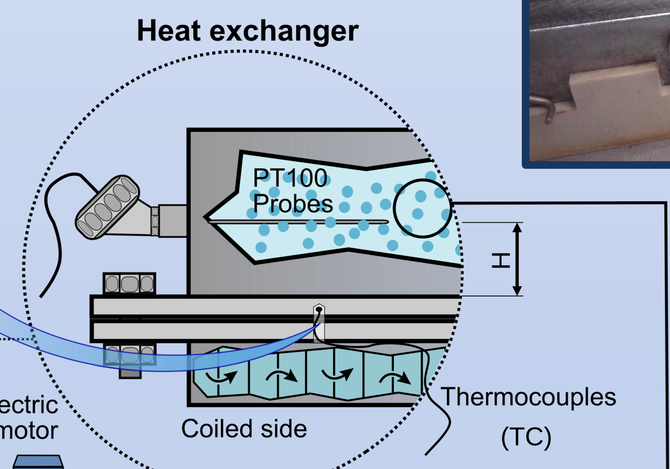
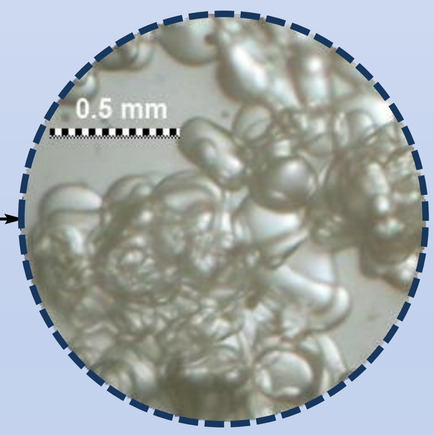


Plate TC's distribution

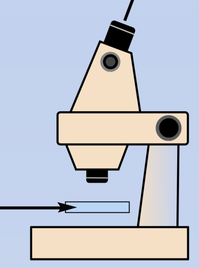


Scraper blades with the springs of the adaptive contact system

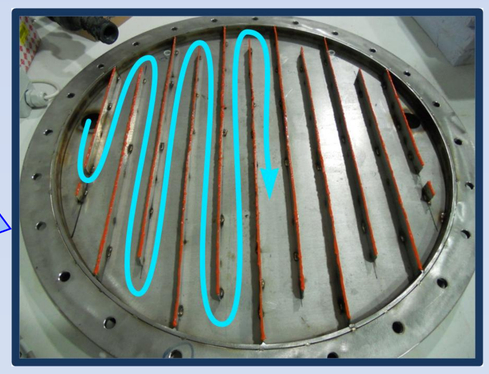




Ice crystals



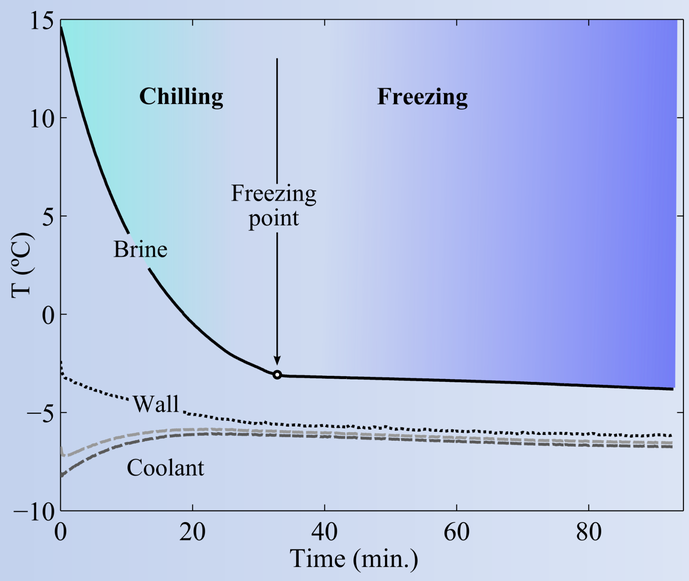
Microscope



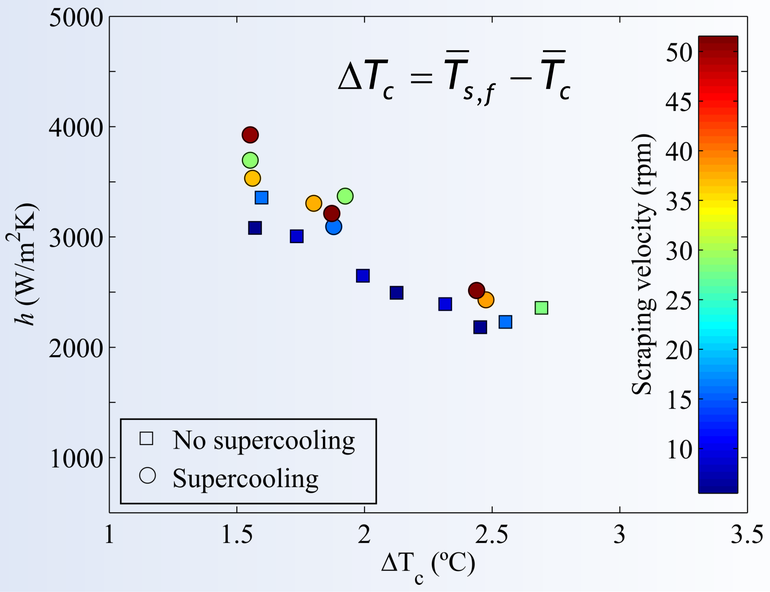
Coiled circuit for the $CaCl_2$ coolant in the Heat Exchanger

Characteristic results

Process without supercooling



7% of NaCl, 10% of ice content



Process with supercooling