

# Mechanical Engineering Thesis Defense

Experimental Study of Water-Ice Phase Change  
Process Improvement Using Ultrasonic Energy

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## Abstract

The phase change process of freezing water is an important application in several fields such as ice making, food freezing technologies, pharmaceuticals etc. Due to the widespread usage of ice-related products, process improvements in this technology can potentially lead to substantial energy savings. After studying the freezing process of water, the supercooling phenomenon was found to occur which showed a negative effect. Therefore, ultrasound was proposed as a technique to reduce the supercooling effect and improve the heat transfer rate. An experimental study was conducted to analyze the energy expenditures in the freezing process with and without the application of ultrasound. After a set of preliminary experiments, an intermittent application of ultrasound at 10W & 3.5W power levels were found to be more effective than constant-power application, and were explored in further detail. The supercooling phenomenon was thoroughly studied through iterative experiments. It was also found that the application of ultrasound during the freezing process led to the formation of shard-like ice crystals. From the intermittent ultrasound experiments performed at 10W and 3.5W power levels, percentage energy enhancements relative to no ultrasound of 8.85% and 11.86% were observed, respectively.



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Zoom Link: <https://asu.zoom.us/j/81714885682>