This dissertation describes a new method to enhance the heat transfer property of single phase liquid by adding encapsulated phase change nanoparticles (nano-PCMs) which will absorb thermal energy during melting and release heat during freeze. Silica encapsulated indium nanoparticles, and polymer encapsulated paraffin (wax) nanoparticles have been made, characterized and dispersed into poly-α-olefin (PAO) and water for potential high temperature and low temperature applications, respectively. The shells prevent leakage and agglomeration of phase change nanoparticles during melting, and enhanced dielectric properties of phase change nanoparticles. The heat transfer coefficients of nanoparticle-containing fluids are higher than those of single phase fluids. The high viscosity can be controlled by surface modification. Super-cooling is greatly reduced by forming porous semi-crystalline silica shell around indium. In addition, encapsulated nano-PCMs have been added into exothermic reaction systems to effectively quench local hot spot, prevent thermal runaway, and change product distribution.

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The public is welcome to attend.