Seminar

Institute for Plasma Research

Title : Thermo-physical properties of nanofluids

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Venue : Online - Join the talk:
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Abstract :

This thesis is based on the topic of thermophysical properties with boiling heat transfer in nanofluids.The topic of heat transfer in Nanofluids is very popular and researched nearly for two decades. Some application of nanofluids in some areas of heat transfer required further attention. Boiling is one of them.The aim of this thesis is to address the pool and flow boiling heat transfer in nanofluids. For the best conduct of this research problem, the experimental investigation is divided into three segments.

Quasi-spherical nanoparticles of Al2O3 and TiO2 were dispersed in water 1 hour of using magnetic stirring followed by 3 hours of ultrasonication to prepare their nanofluids at 0.01-1 % wt. fractions. The stability of nanofluids is examined by visual inspection, Dynamic light scattering, and zeta potential analysis. The nanofluids showed good dispersion stability.

Thermo-physical properties of nanofluids such as thermal conductivity, viscosity, density, and specific heat were measured at studied concentrations with varying temperatures from 25-65 ^{o}C. Change in concentration and temperature have direct effect on thermo-physical properties of nanofluids.

Pool boiling heat transfer in nanofluids was examined. A horizontal flat polished stainless steel plate was chosen as the boiling surface. Significant improvements in the pool boiling heat transfer coefficient and critical heat flux were recorded up to 0.1 %. However, a decrease in pool boiling heat transfer performance was observed at other concentrations. The surface wettability of nanofluids was improved as the static contact angle on the boiling surface decreased with an increase in mass fraction. The roughness of thepool boiling surface decreased due to the development of a layer of nanoparticles on it. Al2O3–water nanofluids showed better boiling performance than TiO2–water nanofluids.

Forced convective flow boiling heat transfer under subcooled region was analysed with Al2O3-water and TiO2-water nanofluid flow in a horizontal tube. An experimental test rig was setup to study the flow boiling heat transfer. The effects of concentration, heat flux, flow rate, surface roughness on heat transfer coefficient were measured. A significant vii increase in convective heat transfer coefficient (HTC) was found due to enhancement in the thermophysical properties of nanofluids. Increase in pressure drop was registered with the rise of concentration and flow rate. Again, Al2O3–water nanofluids showed better boiling performance than TiO2–water nanofluids. Finally, performance evaluation criterion (PEC) showed that nanofluids could improve the overall thermal performance of the system in comparison with pure water. Overall, the present study signifies that nanofluids have the ability to be the future cooling medium for various industrial applications such as heat transfer, process, automobile, nuclear power sector etc.