DEVELOPMENT OF EMPIRICAL RELATIONS FOR THE PREDICTION OF HEAT FLUX USING AL$_2$O$_3$ -WATER NANOFLUID

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ABSTRACT

Nanofluids are the new class of technology fluids developed by dispersing high thermal conductivity nano particles to the base fluids. Cooling techniques are one of the vital points in industries and using high heat transfer medium for the cooling of high energy equipments and machineries and the way to develop the traditional fluids to a high thermal heat transfer fluid is crucial. Development of high thermal fluid as a nanofluid is purely depends on the thermal and physical properties of base fluid and the particles dispersed on it and some other factors on which it depends like particle shape, particle size and the particle concentration. This paper explains the thermal properties of nanofluid viz., thermal conductivity, specific heat and other thermal properties. A theoretical correlation have been developed to predict the heat flux for nucleate pool boiling of Al$_2$O$_3$-Water nanofluids considering the effects of temperature, volume fraction and shape of the particle while neglecting Brownian motion of the nanoparticle, cluster/particle agglomeration and the development of the liquid layer over the plate surface. The predicted result has been compared with the Rohsenow equation and the experimental data of other investigators which shows a good agreement. Using this equation, heat transfer coefficient and heat transfer enhancement ratio of the nucleate pool boiling of Al$_2$O$_3$-Water nanofluids have been calculated. This enhanced thermo physical and heat transfer characteristics of developed fluid dispersed with nanoparticles can be used for the high heat transfer medium for future applications.

KEYWORDS: Empirical Relation, Nanofluids, Pool Boiling Heat Transfer, Thermo Physical Properties