Nanofluids: A newfangled technology to intensify heat transfer

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Abstract: Microsized particles help to improve thermal conductivity and convective heat transfer of liquids when mixed with base fluids. Meanwhile, the path of fluid is disturbed and there is an occurrence of high-pressure drop due to excessive wear, sedimentation and clogging because of micro-sized particles. These problems are overcoming and improvements in thermal properties are achieved by using nanofluids.

Nanofluid are engineered colloidal suspensions of nanoparticles in a base fluid. Metals, oxides, carbides, or carbon nanotubes are used as nanoparticles in these fluids. Nanoparticles have advantages such as larger relative surface area, high mobility, less particle momentum, better stability under the suspended condition and improved thermal conductivity of the mixer than microsized particles. Hence, one of the properties of these fluids is it tremendously enhances the heat transfer characteristics of the original fluid. Here with the increase in all the values of the mass flow rates and with the increase in volume concentration of the nanofluid, the overall heat transfer coefficient also increases. In fact, there is a greater energy absorption by nanoparticles than pure water at a low flow rate. The energy equation of conduction for thermal conductivity is given by:

$$\frac{1}{\alpha}\frac{\partial T}{\partial t} = \nabla^2 T$$

When an experiment was conducted on Al_2O_3 and CuO nanoparticles with water as base fluid at various particle volume concentrations, the result is represented in the figure.

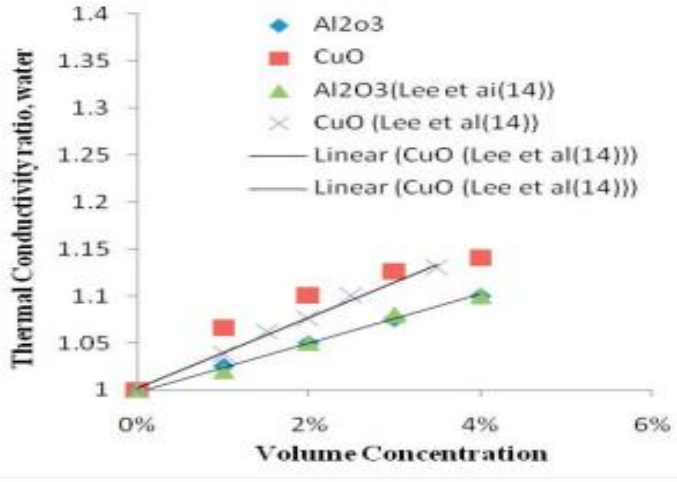

Figure: With the use of nanoparticles: enhancement of thermal conductivity.

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