National Institute of Technology Rourkela

Departmental Seminar

Seminar Title	: Single Phase Heat Transfer of Water-Ethanol Mixture in Microchannel
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Abstract	: This paper presents a numerical investigation of a single-phase heat transfer of a binary mixture of water and ethanol in a square microchannel. The simulation has been carried out in a copper square microchannel with a hydraulic diameter of 0.4 mm, with a heat flux of 10 kW/m2 for different volume concentrations of ethanol in the mixture under a laminar flow condition. The properties of pure fluids in the mixture have been taken as temperature-dependent, and mixture properties are taken as composition-dependent based on the Jouyban-Acree model. The preliminary results of the simulation show that the variation of the average Nusselt number for various volume concentrations of ethanol in the mixture mainly depends upon the Prandtl number of the mixture. The Prandtl number of the mixture initially increases as the volume concentration of ethanol increases due to a rise in momentum diffusivity and a decrease of thermal diffusivity in the mixture. Still, after a certain point of concentration, the momentum diffusivity also decreases along with thermal diffusivity, so the Prandtl number also decreases. So there exists an optimum concentration where the Prandtl number is maximum. The average Nusselt number also follows the same variation as the Prandtl number, so an optimum ethanol concentration exists where we get a maximum average Nusselt number. The maximum Nusselt number at optimum concentration is 8.66% and 2.72% more than the Nusselt number obtained for water and ethanol, respectively, as pure fluids.