

Thermal Conductivity of Liquids Filled with Nanoparticles

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The increasing availability and diversity of nanoparticles has led to their increasing use as additives to liquids in order to obtain an emulsion with tuned physical properties. Studying the effect on the thermal conductivity is interesting both from the applied and fundamental point of view. For some nanoparticle-liquid combinations, a thermal conductivity enhancement has been reported [1]. If the additional viscosity increase is not too large, this enhancement is an important aspect improving the functionality of the liquid as a cooling fluid. Theories are being developed to predict the thermal conductivity of emulsions with different concentrations of particles [2].

In this paper we present precise photothermally determined [3] thermal conductivity values of different combinations and concentrations of nanoparticles and liquids. In particular we present data on the thermal conductivity of aerosil particles suspended in water, gold particles suspended in water, and carbon single wall nanohorns (SWNH) suspended in oil. The accuracy of our method is better than 2 %. We found a significant thermal conductivity decrease for the aerosil-water suspension, and a negligible or very small increase for the other suspensions.

- [1] M.J. Assael, C.-F. Chen, I. Metaxa, W.A. Wakeham, "Thermal conductivity of suspensions of carbon nanotubes in water", Proceedings of 15th Symposium on thermophysical properties, Boulder, CO, USA, June 22 - 27, 2003, p. 714, <http://symp15.nist.gov/pdf/p714.pdf>.
- [2] Yajie Ren, Huaqing Xie and An Cai, *J. Phys. D: Appl. Phys.* **38**, 3958 (2005).
- [3] J.Caerels, C.Glorieux and J.Thoen, *Rev. Scient. Instr.* **69**(6), 2452 (1998).