Abstract Submitted
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Thermal conductivity of nanoparticle suspensions DAVID CAHILL, SHAWN PUTNAM, University of Illinois — We present our experimental study on the thermal conductivity of nanofluids loaded with small volume fractions of C_{60}-C_{70} fullerenes and alkanethiolate-protected Au nanoparticles. We use an optical beam deflection technique that measures the thermal diffusivity of fluid mixtures and suspensions of nanoparticles with a precision of better than 1%. Our approach is tested using the thermal conductivity of ethanol-water mixtures; in nearly pure ethanol, the increase in thermal conductivity with water concentration is a factor of two larger than predicted by effective medium theory. The solutions of the C_{60}-C_{70} fullerenes and the alkanethiolate-protected Au nanoparticles were measured to maximum volume fractions of 0.6% and 0.35 vol%, respectively. We do not observe anomalous enhancements of the thermal conductivity that have been reported in previous studies of nanofluids; the largest increase in thermal conductivity we have observed is 1.3±0.8% for 4 nm diameter Au particles suspended in ethanol. However, within the context of effective medium theory, these findings are expected: effective medium theory predicts that the largest possible increase in the thermal conductivity of a fluid loaded by a volume fraction $\phi \ll 1$ of spherical particles will be $3\phi\Lambda_0$, where Λ_0 is the thermal conductivity of the carrier fluid.

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