Improving the heat transfer efficiency of synthetic oil with silica nanoparticles

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The introduction of nano-sized particles to heat transfer fluids (nanofluids) is an emerging thermal management concept with implications in many disciplines including power generation, transportation, microelectronics, chemical engineering, aerospace and manufacturing. In this study we assess the possible benefits of adding silicon dioxide nanoparticles and surfactant to an aromatic high temperature heat transfer fluid. The heat transfer properties of synthetic oil (Therminol 66) used for high temperature applications (150°C to 400°C) are shown to improve by introducing 15 nrn silicon dioxide nanoparticles. Stable suspensions of inorganic nanoparticle in the non-polar fluid are achieved with using cationic surfactants. The approaches to stabilization of silica nanoparticle suspensions in synthetic oils presented here can also be used to stabilize silica coated core/shell multifunctional nanoparticles, which exhibit great potential for future nanotechnologies. The effects of nanoparticle and surfactant concentrations on viscosity, thermal conductivity and total heat absorption of these nanofluids are studied in a wide temperature range. The experimental data are used to estimate the heat transfer efficiency for both turbulent and laminar flow regimes and to guide the optimization of the nanofluid composition for a better heat transfer performance.

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