Carbon Nanofluids as New Liquid Coolants

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Carbon Nanofluids as New Liquid Coolants
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Abstract
This study investigates the performance of carbon nano fiber/ethylene glycol nanofluids as thermal management fluids. AG, LHT, and HHT carbon nanofibers were tested at varying concentrations, using static, dynamic shear, and pipe flow tests. These tests showed that higher crystallinity and concentration lead to better thermal conduction. However, nanoparticles with higher crystallinities tend to break down under high shear. Raman tests and SEM images were used to confirm this finding. This study shows that low concentrations of LHT nanofluids can result in major improvements in heat transfer.

Introduction
Problem: Poor performance of current heat transfer fluids.
– Limits current devices’ abilities.
Old Solutions: Add highly conductive solids.
– Added micro and millimeter size particles, but they tend to fall out of suspension and clog the pipes.
– Change geometry of system, which often requires larger not smaller systems.
New Solution: Nanofluids

Test Setups
Static: Used transient hot wire test to find the thermal conductivity of each fluid under static conditions.
Dynamic Shear: Used to determine the thermal resistance of each fluid under 6 different shear rates.
Pipe Flow: Used to determine the convective heat transfer coefficient of each fluid through a copper pipe.
Note: See power point for greater detail.

Conclusions
Static Situations: Higher crystallinity and concentrations lead to better conductivity.
Dynamic Situations: Particles with high crystallinities tend to break down under shear, making them less effective.
LHT: Low concentrations of LHT nanofluids show great potential. They had good improvements in performance with little negative effects.
Viscosity and Shear: These are major issues that can negatively effect the performance of a nanofluid.
Need to see entire picture: Just because a fluid performs well under static conditions does not mean it will perform well in practical applications.

Dynamic Shear Results

Pipe Flow Results

Static Results

Dynamic Situations: Higher crystallinity and concentrations lead to better conductivity.
Dynamic Situations: Particles with high crystallinities tend to break down under shear, making them less effective.
LHT: Low concentrations of LHT nanofluids show great potential. They had good improvements in performance with little negative effects.
Viscosity and Shear: These are major issues that can negatively effect the performance of a nanofluid.
Need to see entire picture: Just because a fluid performs well under static conditions does not mean it will perform well in practical applications.