High thermal conductivity materials containing graphene and carbon nanotubes

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Recently, there are a lot of interest in utilizing high thermal conductivity materials for heat dissipation in high power electronic components, devices and apparatus. Graphene (Gr) and Carbon nanotubes (CNTs) are known as excellent additives for thermal materials because their very high thermal conductivity. In this report, we present our obtained results on synthesis and application of high thermal conductivity materials including nano thermal greases, nanofluids and nano-lubrication oils containing Graphene and CNTs. The experimental results on adding CNTs and Gr into thermal greases showed that the thermal conductivity of CNTs and Graphene thermal greases increased 80% and 230% compare to normal greases, respectively. When using CNTs thermal greases and Graphene thermal greases in heat dissipation for Intel Pentium Core i5, the saturation temperature of the CPU decreased 3°C and 6°C, respectively. Nanoliquids containing Graphene and CNTs based distilled water/ethylene glycol (DW/EG) were successfully applied in heat dissipation for Intel Core-i5 processor and 450 W Floodlight LED. The experimental results showed that the saturation temperature of the Intel Core-i5 processor and 450 W Floodlight LED decreased about 6°C and 3.5°C when using nanoliquids, respectively. The CNTs was also effectively utilized as additive material for synthesis of lubricating oils to improve the thermal conductivity, heat dissipation efficiency and performance efficiency of the engine. The experimental results show that the thermal conductivity of lubricating oils increased 12.5%, the engine saved 15% fuel consumption, and the longevity of the lubricating oil increased upto 20,000 km by using 0.1% vol. CNTs in the lubricating oils. The all obtained results confirmed the advantages of heat conductive materials containing Graphene and CNTs in thermal management for high power electronic devices, internal combustion engines and other high-power apparatus.

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