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Nanoparticles, nanosuspension, stability and their improved thermal properties

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Since the last few ages, several studies have been conducted on nano-fluids research containing metal oxides; graphene, carbon-based and their composites/hybrid are rapidly growing for energy improvements. Conventional fluids like water, DW, EG, PEG, palm oil, glycerin and transformer oil have limited thermal and heat transfer properties, so there is a need for some alternative heat exchanging liquids. The prime aim to write this comprehensive article is to synthesize nanoparticles, nano-fluids preparation and detailed applications in different aspects with enhanced thermo physical properties. Different nanoparticles were synthesized using varying synthesis techniques likes (Sonochemical, Precipitation, Sol-Gel, Hydrothermal, and green functionalization and then a 2-step method were used to prepare nano-fluids. Nano-fluids proved their enhanced heat transfer properties as compared to conventional fluids, including their enhanced thermal and rheological characteristics. The improvement in thermo physical and thermal properties of Metal oxides, Ceramics, Graphene oxide and Carbon nanotubes based on single and hybrid nano-fluids was reported here. The 0.025%, 0.05%, 0.075%, 0.1%, 1%, 2% and 3% weight concentrations of the solid nanoparticles dispersed in base fluids showed improved thermo physical and heat transfer properties. A significant improvement in thermal conductivity was found at 49%, 43.7%, 41%, 37.2%, 27%, and 17% at higher wt.% concentrations for the metal oxide-based nano-fluids. Similarly, the higher heat transfer improvement was reported up to 89%, 82% and 72%, 69% and 57% at higher wt.% concentration for Graphene and CNTs-based nano-fluids. This review also covers the stability and dispersion to see the longer suspension of the particles in the base fluid, the graphene oxide and CNTs-based nano-fluids exhibit longer suspension up to 10 weeks after the preparation.

Biography

Waqar Ahmed has done his PhD degree in Materials Physics (Distinction+GOT Excellence award with 10 ISI papers+1 Patent) from the University of Malaya world QS ranking 65. As a PhD researcher at the Institute for advanced studies at the University of Malaya, he has led his research activities to synthesize the metal oxides, graphene, carbon nanotubes and their binary and ternary composite for energy-related varying applications like (Energy storage, sensors, energy transportation, Heat and Mass Transfer, Heating and cooling of Electrical and electronic systems, which helps in solidified his interest in the area of materials and nano-fluids. These experiences have reinforced his keen interest in materials which inspired his goal for a career in synthesis and applications of nanomaterials. He was able to use his analytical skills to organize and assess the data for future academic and research activities. Also, he has completed his master's degree in electrical engineering from COMSATS Institute of Information Technology, Wah Cantt, Pakistan. Research activities at COMSATS were focused on the development of micro/Nanocomposite advanced materials for Outdoor High voltage Insulation. So far, he has published 53 high-impact peer-reviewed original research articles 1 in highly reputable journals such as RSRE, Energy, Renewable energy, ICHMT, JTAC, LDIS, Energies and Energy reports, etc. In most of his published work, he is the first/corresponding author.

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