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Thermophysical Properties and Heat Transfer Performance of g-C₃N₄ Nanofluids in Distilled Water–Ethylene Glycol Mixtures

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In this study, graphitic carbon nitride (g-C₃N₄) nanofluids were systematically prepared and evaluated using distilled water (DW) and ethylene glycol (EG) as base fluids in varying volume ratios of 100:0, 0:100, 30:70, 70:30, and 50:50 (DW:EG). A two-step dispersion method was employed, where pre-synthesized g-C₃N₄ nanoparticles were incorporated into the base fluids at different weight concentrations of 0.01, 0.03, and 0.05 wt%, followed by magnetic stirring and ultrasonication to achieve stable suspensions.

The stability of the prepared nanofluids was assessed using zeta potential analysis and sedimentation observation, confirming good dispersion behavior across selected compositions. The influence of nanoparticle concentration, base fluid ratio, and temperature on thermophysical properties was systematically investigated. Viscosity measurements revealed a moderate increase with nanoparticle loading, while maintaining acceptable flow characteristics, particularly in DW-rich mixtures. Thermal conductivity showed a significant enhancement with increasing g-C₃N₄ concentration and temperature, with hybrid base fluids (DW–EG mixtures) demonstrating optimized performance due to synergistic effects.

Furthermore, heat transfer capability was evaluated under varying thermal conditions, indicating that nanofluids with balanced DW:EG ratios (e.g., 50:50 and 70:30) exhibited superior performance compared to pure base fluids. The enhancement is attributed to improved particle dispersion, Brownian motion, and interfacial heat transport mechanisms. Overall, g-C₃N₄ nanofluids prepared in DW–EG mixtures show strong potential for advanced thermal management applications such as heat exchangers and cooling systems.

Biography

Mekonen Asefa has completed his Masters degree at the age of 26 years from Budapest University of Technology and Economics. Currently, he is the student PhD on Materials and Chemical Engineering at University of Miskolc, Hungary. He presented papers in more than 5 national and international conferences.