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THE ROLE OF NANOMATERIALS IN HEAT EXCHANGE SYSTEMS

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Annotation: Nanotechnology has revolutionized heat transfer processes across various industries. This study investigates how nanomaterials improve the efficiency of heat exchange systems by enhancing thermal conductivity, reducing fouling, and enabling compact design solutions.

Keywords: Nanofluids, heat exchangers, thermal conductivity, nanotechnology, energy systems

Main Text

Heat exchange systems are vital for maintaining energy balance in industrial, automotive, and HVAC applications. Traditional working fluids often exhibit limited thermal conductivity. Nanofluids—fluids containing suspended nanoparticles such as Al_2O_3, CuO, or graphene—have demonstrated remarkable improvements in heat transfer rates.

Experimental studies show that even a 1% volume concentration of nanoparticles can enhance thermal conductivity by 10–30%. Moreover, nanocoatings applied to heat exchanger surfaces prevent corrosion and fouling, ensuring long-term performance stability. Compact plate heat exchangers using nanofluids achieve higher heat transfer coefficients while minimizing system weight and energy consumption.

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