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Novel nanofluid based on water-loaded delafossite $CuAlO_2$ nanowires: Structural and thermal properties

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Ultra-high cooling performance is a crucial requirement of many thermomechanical systems, such as microelectronic devices, engine cooling systems, nuclear power systems, chemical reactors, and refrigeration systems. Recent experimental results reveal the potential thermal properties of suspended nanometallic in conventional fluids. In this study, the facile synthesis of one-dimensional delafossite $CuAlO_2$ nanowires by microwave hydrothermal treatment was presented. A novel type of nanofluid consisting of $CuAlO_2$ nanowires suspended in distilled water at various volume fractions (0.0, 0.2, 0.4, and 0.6 wt.%) was successfully synthesized using an easily scalable sonication method. The microstructures of as-synthesized $CuAlO_2$ were investigated by adopting X-ray diffraction (XRD), energy dispersive X-ray spectroscopy (EDS), transmission electron microscopy (TEM), and field-emission scanning electron microscopy (FESEM). Furthermore, the thermal conductivity and specific heat capacity of water-loaded nanofluid were measured at different volume fractions and temperatures. The results reveal a significant increase in thermal conductivity with increasing $CuAlO_2$ loading levels and temperatures. The obtained results propound the fact that water-loaded delafossite $CuAlO_2$ nanowires-based nanofluid is a promising candidate for future industrial applications.

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