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Full-Spectrum Photo-thermal Conversion of Point-mode Cu_2O/TiN Plasmonic Nanofluids

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Abstract : Core-shell composite structure is a common method to regulate the spectral absorption of nanofluids, but there occur complex preparation processes, which limit the applications in some fields, such as photothermal utilization and catalysis. This work proposed point-mode Cu_2O/TiN plasmonic nanofluids to regulate the spectral capturing ability and simplify the preparation process. Non-noble TiN nanoparticles with the localized surface plasmon resonance effect are dispersed in Cu_2O nanoparticles for forming a multi-point resonance source to enhance the spectral absorption performance. The experimental results indicate that the multiple resonance effect of TiN effectively improves the optical absorption and expands the absorption region. When the radius of Cu_2O nanoparticles is equal to 150nm, the optical absorption of point-mode Cu_2O/TiN plasmonic nanoparticles is best. Moreover, the photothermal conversion efficiency of Cu_2O/TiN plasmonic nanofluid can reach 97.5% at a volume fraction of 0.015% and an optical depth of 10mm. The point-mode nanostructure effectively enhances the optical absorption properties and greatly simplifies the preparation process of the composite nanoparticles, which can promote the application of multi-component photonic nanoparticles in the field of solar energy.

Keywords : solar energy, nanofluid, point-mode structure, Cu_2O/TiN, localized surface plasmon resonance effect
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