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Enhanced structural, optical and electrical properties of copper telluride nanoparticles

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The great deal of attention that semiconductor nanoparticles have got stems from their unique size and shape dependent structural, optical and electrical properties, which can be harnessed for electronic, optical, thermoelectrical, magnetic and optoelectronic devices. Metal tellurides belong to an important class of materials, semiconductor nanoparticles, which show quantum confinement phenomenon and received attention due to size and shape dependent properties and aforementioned applications. Owing to these properties and applications, the present study is focused on a systematic and extensive work to synthesize and characterize copper telluride nanoparticles by using a special type of size and shape controlling agents i.e. Gemini surfactants. These surfactants represent a new class of surfactants and characterized by much lower critical micelle concentration values and stronger surface tension reduction efficiency than the corresponding conventional surfactants. In the present work, a versatile and facile methodology is presented for size-and shape-controlled copper telluride nanoparticles in the presence of highly hydrophobic cationic gemini surfactants (12-2-12, 14-2-14, and 16-2-16) as size and shape controlling agents. The structural optical and electrical properties of the prepared $Cu_{(2-x)}Te$ nanoparticles were investigated in relation to the cumulative diameter of nanoparticles by using different surfactants. The average particle size of synthesized $Cu_{(2-x)}Te$ nanoparticles gradually increased as a function of hydrocarbon chain length of gemini surfactants. Accordingly, the decrement in the optical band gap of $Cu_{(2-x)}Te$ nanoparticles was observed and it decreased from 3.42 to 3.37eV, respectively, which may be attributed to a quantum size effect in the NPs. In addition, the current-voltage (I-V) studies performed at room temperature will be discussed in detail.

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