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Environment friendly surfactant free hydrophilic Cu_2ZnSnS_4 and $Cu_2ZnSnSe_4$ nanocrystal inks for cost effective photovoltaic applications

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The inexpensively and easily printable nanocrystalline semiconductor colloidal inks with tunable optical and electrical properties are easily exploitable by simple printing techniques, helpful in large scale device fabrication. But there are limitations of using hi-tech instrumentation for maintaining inert environmental conditions or high temperature annealing required for the removal of surfactants attached to the material which unless removed leads to lower device efficiency. Also, the organic solvents and surfactants used during colloidal synthesis may leads to various environmental hazards. The newest approach to overcome these technical hitches and environmental problems is surfactant free hydrophilic ink form of the material that have the advantages of ease of application and throughout elemental homogeneity as that of colloidal ink and evades the use of hazardous chemicals and any high cost intricate instrumentation. Quaternary Cu_2ZnSnS_4 and $Cu_2ZnSnSe_4$ semiconductors are already proven potential candidates for photovoltaic applications. Here, we are presenting a simple green hydrothermal method for the synthesis of surfactant free hydrophilic Cu_2ZnSnS_4 and $Cu_2ZnSnSe_4$ ink constitutes ultrafine nanoparticles well dispersed in polar solvents such as water or ethanol. The high quality, phase purity and quantum confined nature of the nanoparticles is confirmed by XRD, Raman and UV-Vis analysis respectively. TEM and HR-TEM revels the single crystalline nature of the as-synthesized nanoparticles while elemental analysis with SEM-EDS shows elemental homogeneity with good stoichiometric distribution. The calculated resistivity of the p-type semiconductor materials from I-V measurements depicts the high electronic mobility due to the absence of any surfactant suggesting enhanced photovoltaic efficiency.

Biography

Priya Kush received her Master's degree in Chemistry in 2010 from Department of Chemistry, University of Delhi and is working as a Ph.D. student at the same since 2010. She was awarded with UGC-junior research fellowship (2010) and UGC-senior research fellowship (2012) for her doctoral work. Her research area includes synthesis, characterization and application of novel photovoltaic nanomaterials for low cost solar cell applications and she has published two papers in reputed journals in 2013.

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Renewable energy solution from solar cells to nano-leaves (green energy model)

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Harvesting energy from the environment responsibly is important. Natural trees and plant do this phenomenon efficiently already from millions of years. Our invention is mimicking of this ingenious concept as a renewable energy source. This particular model relates to the block diagram and shapes and form of leaves, needles and their incorporated nano-materials that allows the nano-leaves to harvest capture environmental energies like solar radiation, wind and heat radiation and turn them into electricity efficiently.

In the natural leaves plastids contains chlorophyll, a green-colored pigment that absorbs sunlight, and allows the plant for the photosynthesis.

Similarly in nano-leaves absorbs the solar radiation or other type of light radiation by photovoltaic layer and produces the electrical signal similar when the environment is hot or cold then the thermo-voltaic layer produces the electrical signal. With this the piezo-electric layer is also there to convert the wind motion in to electrical signals.

And these electrical signals are controlled by a circuitry and store it in an storage device. This is the only model which converts more then one parameter into electrical signal. This model can be useful for the residential purpose in place of the solar panels.

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