

Preparation of Mesoporous CuO Nanoparticles: Structural and Optical Properties

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Abstract

CuO nanoparticles with disordered mesoporous structure were prepared and characterized in this work. CuO nanoparticles were synthesized using a simple and facile soft template method. The morphology and microstructure of the CuO nanoparticles were characterized using powder x-ray diffraction pattern (XRD), transmission electron microscopy (TEM) and N₂ adsorption-desorption isotherm. The optical property of the specimen was investigated by carried out UV-Vis absorption studies and room temperature photoluminescence (PL) measurement. From the study of UV-Vis spectrum of the prepared CuO nanoparticles, a blue shift in the absorption band was found. This was explained due to the quantum confinement effect. The photoluminescence spectrum of the prepared CuO consists of two overlapping peaks after excitation at 428 nm. This was ascribed due to presence of some defect states in the mesoporous structure of CuO nanoparticles.

Introduction

✓ Mesoporous materials have unique property like high surface area, tunable pore size, large pore volume and stable mesoporous structure.

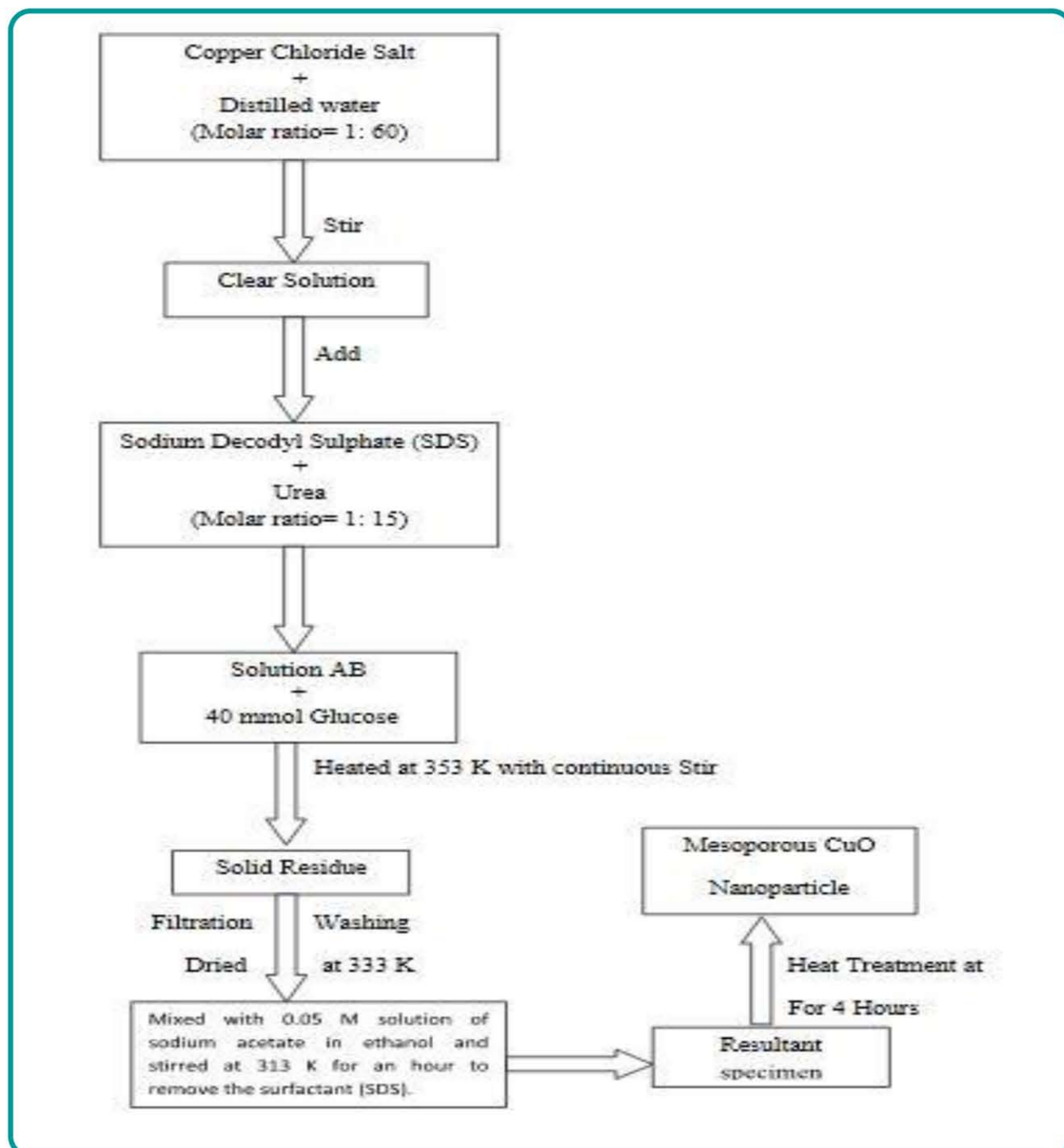
✓ Mesoporous metal oxides has drawn a lot of interest for their potential applications in many area like absorbents, catalysts, optically active systems, humidity and gas sensor.

✓ CuO is a promising materials for catalysis and sensing application

✓ Mesoporous CuO nanoparticles exhibits interesting physical and optical properties

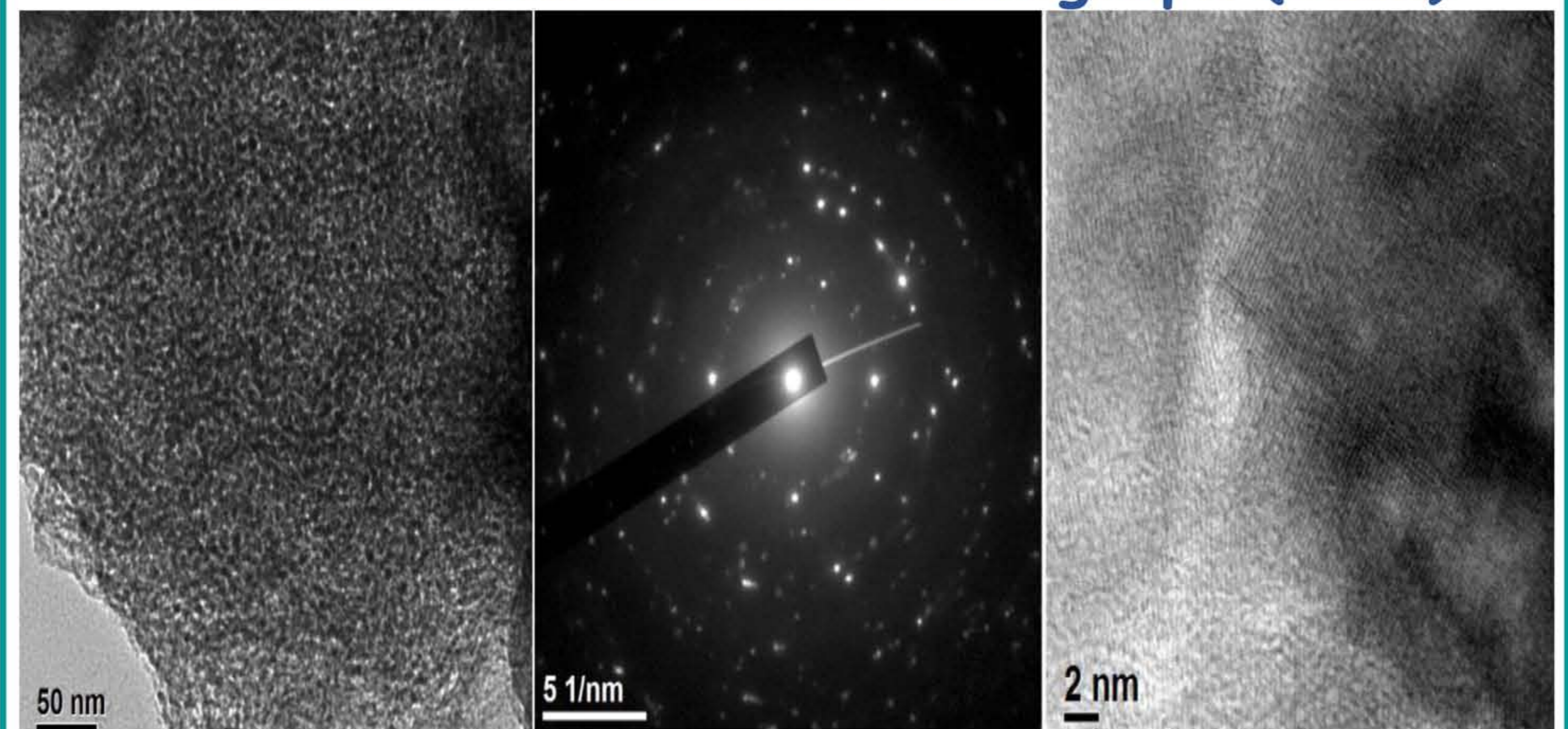
✓ In this work mesoporous CuO nanoparticles were prepared through a simple and facile soft template method

Flow Chart

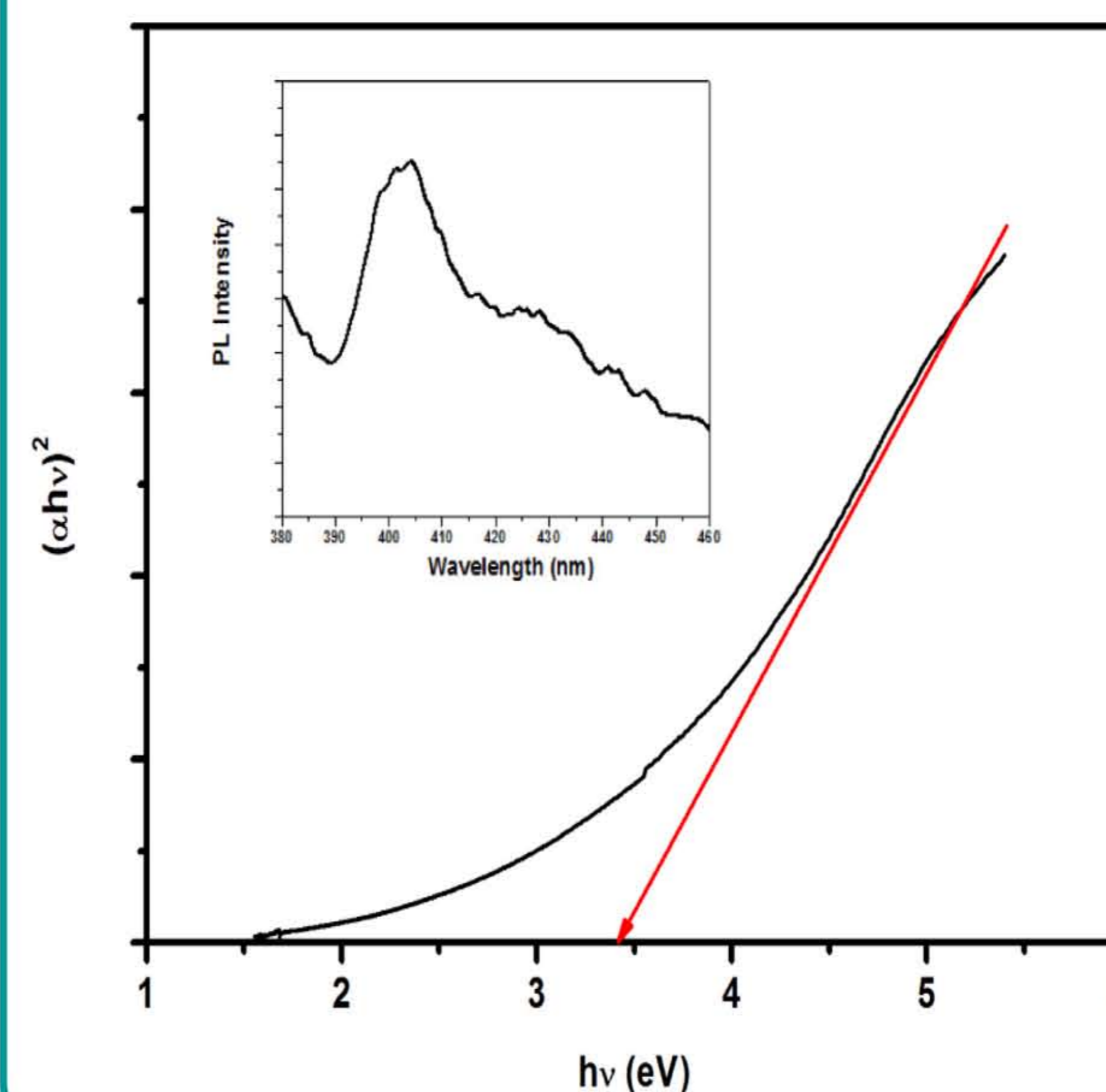


Results

Transmission Electron Micrograph (TEM)



- CuO shows its disordered wormhole-like mesoporous structure confirms by TEM micrograph.
- The SAED and HRTEM confirms the formation of crystalline CuO phase.
- The pore width calculate from TEM image around 10 to 15 nm.



Optical Property

- The band-gap of mesoporous CuO nanoparticles was estimated from uv-vis study as 3.43 eV.
- This Blue-Shift was explained by Quantum Confinement Effect.
- The PL spectra of mCuO exhibit two overlapping peaks for an excitation at 428 nm due to some Defects States.

Conclusions

- CuO nanoparticles with mesoporous structure was synthesized using a simple and facile surfactant assisted (SDS) soft template method.
- The microstructure of the CuO nanoparticles were characterized by x-ray diffraction pattern (XRD) and transmission electron microscopy (TEM).
- The UV-vis study shows that there is blue shift in absorption spectra due to quantum confinement effect.
- The mesoporous CuO nanoparticles exhibit two overlapping PL peaks after an excitation at 428 nm due to some defects states the porous structure.

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