

Sol-gel based synthesis, characterization of copper oxide (CuO) nanoparticles and its applications

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Abstract: In the present work, our focus is on the synthesis of fine black-colored CuO nanoparticles by Sol-gel method. In this method, copper nitrate ($\text{Cu}(\text{NO}_3)_2$), ascorbic acid ($\text{C}_6\text{H}_8\text{O}_6$) and distilled water are used as starting materials. The solution is continuously stirred at a temperature of 70 °C for half an hour. Finally, the solution is heated at 90°C till it dries completely. The dried sample is annealed at a temperature of 200°C for 1 hour followed by calcinations at a temperature of 500°C for 5 hours.

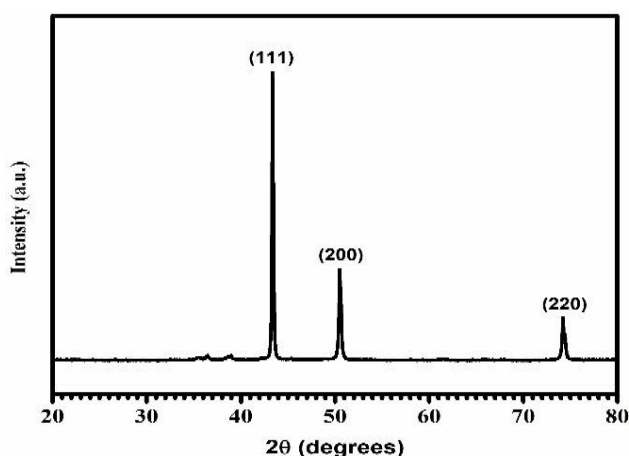


Figure-1. XRD pattern of pure copper nanoparticles

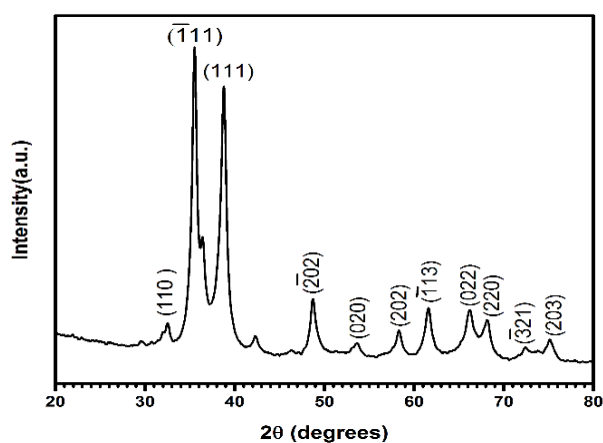


Figure-2. XRD pattern of pure copper nanoparticles

The main advantages of this method are, it is a time saving synthesis approach, there is no need of advanced or complex type of machines / equipment and a good and easy control over the size of nanoparticles just by changing the composition, Ph and temperature of the solution. The synthesized black powder of CuO nanoparticles were characterized by X-Ray Diffraction (XRD) as shown in figure 2 and Scanning electron microscopy (SEM). We observed the fine and nanosize of CuO particles 14 nm. As we know Copper rank as the third most consumed industrial metal in the world, its oxide like CuO nanoparticles have a lot of applications as catalysis, smart gas sensors, power storage batteries, solar energy transformers, magnetic storage chips and field emission etc. As P-type semiconductor with restricted band gap CuO nanoparticles also find potential use in nano devices such as electronic, optoelectronic and sensing.

References:

1. Al-Marzouki, F. M., Al-Hartomy, O. A., & Shah, M. A. (2011). Preparation of Copper Oxide (CuO) Nanoparticles and their Bactericidal Activity. *International Journal of Manufacturing, Materials, and Mechanical Engineering (IJMMME)*, 1(4), 58-64.
2. M. A. Shah and T. Ahmad, *Principles of Nanoscience and Nanotechnology*, Naroosa Publishing House New Delhi.