Square Pulse Galvanostatic Synthesis and Characterization of Nano- Copper Oxide

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In this study, the copper oxide nanoparticles are synthesized by the square pulse galvanostatic method (SPGM) through anodic oxidation of copper electrode in sodium sulfate solution. The released Cu^{2+} ions are precipitated slowly as $\text{Cu}(\text{OH})_2$ nanoparticles. In the temperature more than 40 °C, the copper hydroxide is decomposed to CuO nanoparticles. The electrochemical cell includes one copper positive electrode (anode) and two copper negative electrodes (cathodes) in the sodium sulfate solution as electrolyte. The effects of some parameters such as solution temperature, electrolyte concentration, pulse time, relaxation time and pulse amplitude were studied and optimized. The optimum conditions for the electrosynthesis of copper oxide nanoparticles includes 1×10^{-4} M sodium sulfate solution, the square pulse amplitude of 20 mA cm^{-2} , pulse time of 2 s, relaxation time of 1 s and temperature of 60°C. The produced samples are filtered and washed 3 times with water and finally with acetone and then dried at 600°C for 1 h. The prepared samples are characterized by SEM, TEM and XRD techniques. The experimental data show the optimized copper oxide sample includes uniform CuO nanorods with 35 nm average diameter and 550 nm average length.

Keywords: Square pulse, galvanostatic, electrosynthesis, copper oxide, nanorods.

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