Synthesis of Copper Nanoparticles by Pulsed Electrochemical Dissolution Process

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ABSTRACT

This article reports on the cost-effective electrolytic synthesis of copper nanoparticles using copper sulfate as metal precursor. An in-house experimental apparatus of pulsed-electrochemical dissolution (PECD) process has been conceptualized and developed. Generated nanoparticles were characterized using X-ray diffraction (XRD), scanning electron microscope (SEM), and energy-dispersive X-ray spectroscopy (EDX) to analyze their size, morphology, and chemical composition. Experiments were conducted in two phases, namely preliminary and main experiments. The preliminary experiments were done to study the effects of electrolyte concentration, interelectrode gap (IEG), and processing time on shape and size of the nanoparticles. Average minimum sizes of the nanoparticles obtained during the preliminary experiments were found to be 150 nm at identified optimum parameters, that is, 5 wt % as electrolyte concentration, 30 min as processing time, and 10 mm as IEG. These identified optimum values were used during the main experiments conducted to identify optimum values of applied voltage, pulse-on time, and pulse-off time. Average minimum size of the particles obtained during the main experiments was found to be 70 nm at the identified optimum value of the parameters namely voltage as 8 V, pulse-on time as 4 ms, and pulse-off time as 8 ms.

Keywords: Copper Nanoparticles.