Electrochemical Preparation of Ultrafine Zinc Powder

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In this research work, statistical analysis and optimization of the electrolytic preparation of zinc powder from an alkaline solution containing zinc oxide were carried out using Taguchi methodology. The analysis considered the effect of ZnO concentration (20-80 g L⁻¹), electrolyte temperature (30-70 °C), and current density (150 - 450 mAcm⁻²) on the specific surface area of zinc powder. The effect of organic additives such as D-sorbitol and sucrose on the morphological structure of zinc powder was studied based on the optimum operating conditions of Taguchi design. XRD-diffraction, atomic force microscopy (AFM), BET, and SEM were used to characterize the zinc powder. The results indicate that ZnO concentration has the major effect on the specific surface area of zinc powder followed by current density while the temperature has no significant effect on the specific surface area. The optimum conditions for preparing zinc powder at a higher specific surface area and a nanostructure were a current density of 450 mAcm⁻², an electrolyte temperature of 30 °C, ZnO at a concentration of 20 g L⁻¹, and D-sorbitol at a concentration of 4 g L⁻¹. The current efficiency and energy consumption were 91.3 %, and 3.0 KWh kg⁻¹ respectively. The produced powder has a specific surface area of 6.218 m² g⁻¹ and an average particle size of 67 nm.

Keywords: Taguchi method, zinc powder, specific surface area, electrodeposition, D-sorbitol, sucrose.

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