Electrochemical Characteristics of Nickel Hydroxide Fabricated from a Spent Electroless Plating Bath

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Electroless nickel plating baths must be replaced periodically to retain the quality of the deposited nickel film, thus resulting in a considerable amount of spent plating solution. In the spent plating solution, Ni²⁺ of sufficiently high concentration can be reused for energy storage applications. This study investigated a chemical precipitation method that involved adding sodium hydroxide and polyethylene glycol to generate 0.5-μm Ni(OH)₂ particles. The electrochemical experimental results indicated that an electrode consisting of Ni(OH)₂ and Vulcan XC72 carbon black could provide active sites for charge storage because of the layered structure of the Ni(OH)₂. The interstitial water between the layers enhanced the transport of H⁺ with a diffusivity of 1.4×10⁻¹² cm²/s, which was twice as high as that of an electrode made from commercial Ni(OH)₂. Furthermore, a charging-discharging measurement with 100 cycles revealed that the electrode made with Ni(OH)₂ from a spent plating bath exhibited 88% capacitance retention, which was greater than that of the electrode made from the commercial Ni(OH)₂. Consequently, the method proposed in this study may provide usable materials for energy storage while removing nickel from spent plating baths.

Keywords: Nickel hydroxide, electroless plating bath, precipitation, energy storage

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