Optimization of Zinc Electrodeposition from Zinc-Air Cell Discharge Performance

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ABSTRACT

Porous zinc electrodes were prepared from an acidic, chloride electrolytic bath for application in zinc-air microbattery. The aim is to produce a high specific surface area zinc coating in order to obtain high storage capacity and high limiting current density of the microbattery. The electrolytic bath consists of zinc chloride as the metal source and ammonium chloride as the supporting electrolyte. The concentration of the supporting electrolyte was varied from 1 to 6 M, while the concentration of zinc chloride was fixed at 2 M. The electrodeposition was performed at a constant current density of 100mAcm^{-2}. No electrolyte agitation was attempted. SEM micrographs revealed unique cross-stitch porous network morphology of zinc electrodeposits. As the ammonium chloride concentration increases, flake microstructure appeared and later becomes predominant. A thin alkaline zinc-air cell was fabricated utilizing the various qualities of the zinc electrodeposits. The effect of the qualities of the zinc electrodeposits on the cell discharge performance was monitored. The zinc-air microbattery of 1 cm^2 area x ca. 305 μm thick was able to produce a maximum limiting current density of 35 mA cm^{-2} and possessed a specific capacity of 327 mAh g^{-1}