Int. J. Electrochem. Sci., 13 **(2018)** 324 – 332

International Journal of
ELECTROCHEMICAL
SCIENCE
www.electrochemsci.org

Particle Size Refinement of Zn Electrodeposits in Alkaline Zincate Solutions with Poly (ethylene glycol) (12) Tridecyl Ether. Part II

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doi: 10.20964/2018.01.11

Received: 22 September 2017 / *Accepted:* 31 October 2017 / *Online Published:* 1 December 2017

Electrowinning of zinc from alkaline solutions is a promising technology which can directly produce metallic zinc powder from the treatment of zinc-containing ores and wastes. Fine zinc powder is of great interest in a variety of industries, such as paints, battery electrodes and cementation. This study investigated the effect of Poly (ethylene glycol) (12) tridecyl ether (PTE) on the dendritic growth and the particle size distribution of Zn electrodeposits in alkaline solutions that have similar content as used in industry. The dendritic growth of Zn electrodeposits was studied using current-time technique and scanning electron microscopy (SEM) while the purity was analyzed by energy-dispersive X-ray spectroscopy (EDS) and X-ray diffraction (XRD). The particle size distribution was investigated by sieve analysis, laser particle size analyzer and cathodic potentiodynamic polarization, respectively. The results suggest that the presence of PTE can effectively inhibit the dendritic growth of Zn electrodeposits, where small, flat and layer-less dendrites with high Zn purity (99.34 wt.%) were electrodeposited. The data from the sieve analysis shows that 77.16 wt.% of electrodeposits can pass the sieve up to 150 μm in size after the addition of PTE. This was significantly higher than from the additive-free electrolyte (19.21 wt.%). The cathodic polarization curves suggest that, after the addition of PTE, more negative overpotential of Zn electrodeposition was observed, which increased the nucleation rate of Zn nuclei and more fine zinc particles were produced. These results indicate that PTE is an effective additive for the particle size refinement of Zn electrodeposits in alkaline zincate solutions.

Keywords: Poly (ethylene glycol) (12) Tridecyl Ether; Particle Size Refinement; Alkaline; Electrowinning; Zinc

FULL TEXT