Xiangxin Xue et al., Mater Sci Nanotechnol 2017, 1:2

Electrodeposition of tin on copper from choline chloride based ionic liquids

Xiangxin Xue[1,2], Xiaozhou Cao[1,2], Lulu Xu[1,2], Xiaoyu Zhang[1,2], Qiuyue Li[1,2], Yuanyuan Shi[3], He Yang[1,2] and **Tao Jiang[1,2]**

[1]Northeastern University, China

[2]Key Laboratory of Recycling Science for Metallurgical Resource, China

[3]Chinalco Shenyang Non-ferrous Metal Processing Co., Ltd, China

Tin and its alloys are widely used in various industrial applications including electronics, light engineering, automotive and building materials due to their non-toxic, corrosion resistant and ductile properties. The electrodeposition of Sn and Sn alloys is widely practiced in aqueous electrolytes including sulphuric acid, methanesulronic acid, phenolsufonic acid and citric acid. However, electrodeposition of Sn presents the low current efficiency from aqueous solutions due to a narrow electrochemical window of water. Ionic liquid has wide potential window, high thermal stability, good ionic conductivity and negligible vapor pressure as electrolyte for various electrochemical process. The electrodeposition of Sn on copper substrate was investigated using 0.2mol/L $SnCl_2 \cdot 2H_2O$ dissolved in the eutectic mixture of choline chloride and urea (1:2 molar ratio). A typical voltamperogram at different scan rate is shown in. The curve displays a couple of well-define cathodic and anodic peaks which is a typical metal deposition-stripping process. The reduction peak potential shifts to negative potentialsi with the increase of scan rates, which was associated with quasi-reversible electrochemical reactions. The cathodic peak current versus the square root of the sweep rate for the cyclic voltammograms are shown in Figure 2. It can be seen that the plot displays a liner relationship, indicating that the reduction reaction was a diffusion-controlled process. The microstructure of Sn electrodeposits at different temperatures was analyzed by scanning electron microscopy (SEM) in Figure 3. The results showed that the deposits are compact, and the particles began to grow with the increase of temperature.

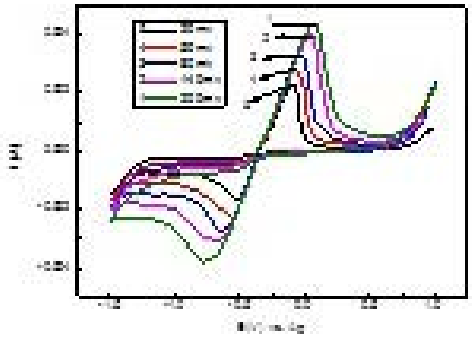

Figure: Cyclic voltammograms of 0.2mol/L $SnCl_2 \cdot 2H_2O$ on Mo electrode in urea-choline chloride at 343K under different scan rates.

Recent Publications

- Anicai L, Petica A, Costovici S, Prioteasa P, Visas T (2013) Electrodepostion of Sn and NiSn alloys coating using choline chloride based ionic liquids-evaluation of corrosion behavior. Electrochimica Acta 114:868-877.
- Walsh F C, Low C T J (2016) A review of developments in the electrodeposition of tin. Surface & Coatings Technology. 288:79-94.
- Anicai L, Costovici S, Cojocare A, Manea A, Visan T (2015) Electrodeposition of Co and CoMo alloys coatings using choline chloride based ionic liquids-evaluation of corrosion behavior. Transactions of the IMF. 93(6):302-312.
- Sakita A M P, Noce R D, Fugibara C S, Benedetti A V (2016) On the cobalt and cobalt oxide electrodeposition from a glyceline deep eutectic solvent. Physical Chemistry Chemical Physics. 18(36):25048-25057.
- Maltanava H M, Vorobyova T N, Vrublevskaya O N (2014) Electrodeposition of tin coatings from ethylene glycol and propylene glycol electrolytes. Surface & Coatings Technology. 254:388-397.

Biography

Xiangxin Xue received his BS, MS and PhD in 1977, 1983 and 1990 from Institute of Metallurgy and Physical Chemistry, Ferrous Metallurgy at Northeastern University. Since June 1998, he became a Professor and Doctoral Tutor. In 2000, he set up the Institute of Metallurgy Resource and Environment Engineering (now department of resource and environment) at Northeastern University. His current research focuses on the comprehensive utilization of metallurgy resource and green metallurgy process flow innovation.

xuexx@mail.neu.edu.cn