Electrodeposition of tin from choline chloride based solvents: Influence of the hydrogen bond donors

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In the recent years the metal deposition from ionic liquids is an area which attracted much attention [1] due to the possibility of depositing metal which cannot be otherwise deposited and for the possibility to replace toxic baths used commercially [2]. One particular type of ionic liquids is called Deep Eutetic Solvent and is based on a mixture of choline chloride with suitable hydrogen bond donors, like ethylene glycol [2].

In this work we show that Deep Eutectic Solvents formed by a mixture of choline chloride and different hydrogen bond donors (urea, ethylene glycol and propylene glycol) can be used for the electrodeposition of tin. Furthermore we demonstrate that the choice of hydrogen bond donor does not affect, significantly, the electrochemistry of tin in solution and we characterize the first stages of tin deposits at glassy-carbon (GC) electrode.

The electrochemical characterization of tin deposits is carried out using cyclic voltammetry, as shown in Fig. 1, and chronoamperometry. The comparison of the theoretically and experimentally obtained current transients via dimensionless plots based on Bewick–Fleischman–Thirsk (BFT) theory, Scharifker and Hills (SH) and Scharifker and Mostany (SM) models and a non-linear fitting method showed that tin nucleation on GC surface occurs though a 3D instantaneous process with growth controlled by diffusion.

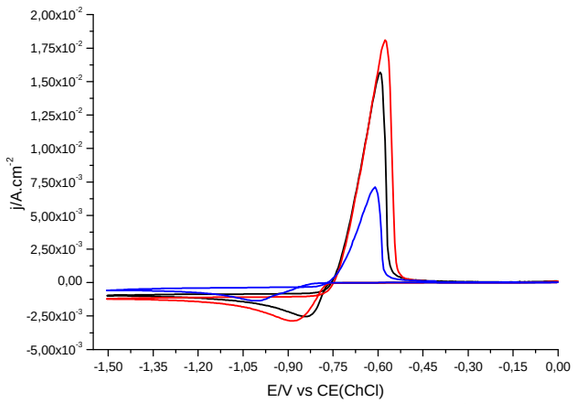

Fig. 1 – Voltammograms (scan rate 20 $mV.s^{-1}$) in reline (blue line), propeline (black line) or ethaline (red line) containing $5x10^{-2}$ $mol.dm^{-3}$ $SnCl_2$ for GC electrode at 75 ºC .

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