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PII: S1572-6657(18)30489-2
DOI: doi:10.1016/j.jelechem.2018.07.023
Reference: JEAC 4173

To appear in: *Journal of Electroanalytical Chemistry*

Received date: 27 April 2018
Revised date: 23 June 2018
Accepted date: 13 July 2018

Please cite this article as: Marcos F. de Carvalho, Ivani A. Carlos , Microstructural characterization of Cu-Sn-Zn electrodeposits produced potentiostatically from acid baths based on trisodium nitrilotriacetic. Jeac (2018), doi:10.1016/j.jelechem.2018.07.023

# Microstructural characterization of Cu-Sn-Zn electrodeposits produced potentiostatically from acid baths based on trisodium nitrilotriacetic

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## Abstract

This study characterizes the Cu-Sn-Zn electrodeposits produced potentiostatically from baths containing different concentrations of $Cu^{2+}$, $Sn^{2+}$ and $Zn^{2+}$ ions and 0.60 M trisodium nitrilotriacetic (NTA) at pH 4.99 (higher stability). Ternary electrodeposits were produced onto AISI 1010 steel substrate at electrodeposition potential of –1.60 V with electrodeposition charge density of 3.0 $Ccm^{-2}$. Chemical composition of electrodeposits varied significantly, presenting higher Cu content (at%) than that of other elements. Furthermore, it was verified that the high concentration of $Sn^{2+}$ ions in the baths hindered the reduction of $Zn^{2+}$ ions, leading to Zn-poor electrodeposits. Microstructure was generally composed of irregular crystallites and clusters of crystallites or dendrites dispersed on the surface, depending on chemical composition. X-ray diffraction showed formation of the ternary alloy by mixture of the $Cu_5Zn_8$, η-$Cu_6Sn_5$ and Sn pure phases. In addition, electrodeposits with lower Cu content (at%) also showed the SnO phase. Surface topography of the electrodeposits presented a rough aspect, with arithmetic roughness varying from 1.83 to 3.90 μm for electrodeposits with lower and higher Sn content (at%), respectively. Adhesion tests