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Influence of organic ligands on electrodeposition and surface properties of nickel films

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Abstract

Presented results describe electrochemistry of Ni^{2+} complexes with glycinate (Gly^-), ethylenediaminetetraacetate (EDTA^{4-}), acetate (Ac^-), citrate (Cit^{3-}), and formate (HCOO^-) ligands in aqueous environment. Electrochemical test indicated possibility of electrochemical synthesis of nickel films at potentiostatic conditions in Ac^- , HCOO^- , Gly^- and Cit^{3-} based systems. Deposition rate is strongly dependent on applied complexing agent. The highest deposition rate, ca. $1900 \text{ ng s}^{-1} \text{ cm}^{-2}$ ($E = -1.1 \text{ V vs. Ag/AgCl}$) was observed in system containing formate nickel complexes. Registered potentiostatic current – time curves combined with electrochemical quartz crystal microbalance (EQCM) indicated the highest current efficiency for Gly^- based system i. e. 0.75 ($954 \text{ ng s}^{-1} \text{ cm}^{-2}$, $E = -1.1 \text{ V vs. Ag/AgCl}$). Voltammograms and XRD patterns indicated that nickel electrodeposition is accompanied by hydrogen absorption. XPS technique indicated the presence of nickel hydroxides on electrodeposited films surface.

Keywords: Ni electrochemistry, electrodeposition, EQCM, voltammetry

1. Introduction

Nickel and its alloys or nickel based composite materials enjoy a lot of interest among many research centres in the world, mainly due to its wide range of potential applications in corrosion protection (ZnNi alloy [1]) and catalysis (NiMo [2], NiPd [3] alloys).

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