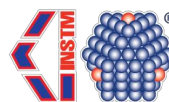




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## Electrodeposition of compact Ag-Ni alloys from concentrated chloride baths

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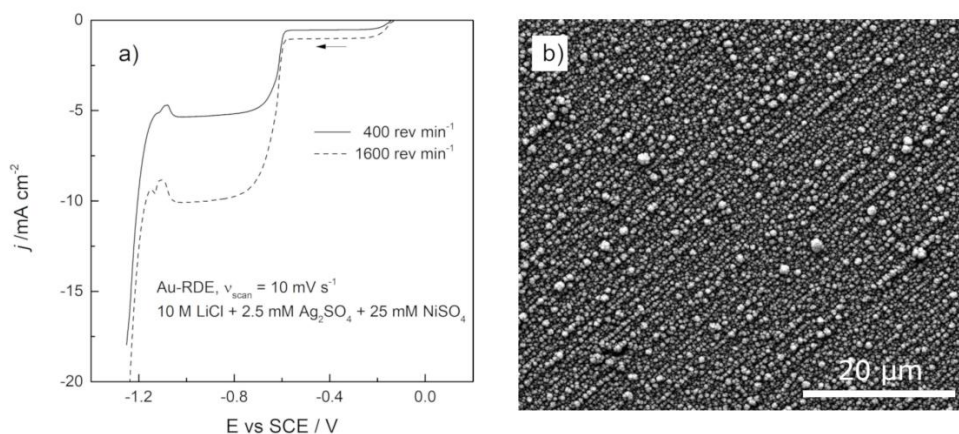
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Ag-Ni alloys or bimetallic structures are arising much interest in the search for efficient and cheap materials in many applications, from electrical devices to (electro)catalysis [1]. Ag and Ni crystallize both in the fcc structure, but are immiscible in the solid state at equilibrium. Electrodeposition of Ag-Ni is complicated by the large difference in redox potentials ( $E^0 = 0.799$  V and  $E^0 = -0.25$  V for Ag and Ni, resp.), leading to formation of porous deposits in the absence of suitable additives [2]. Deposition baths should provide a complexation of Ag ions shifting closer the two reduction processes. Cyanide baths work well for the deposition of Ag alloys [3], but pose a severe safety hazard. Fairly good results are obtained using thiourea baths, but the obtained layers include up to 20 at% of sulfur [2].

The use of concentrated chloride baths as an alternative to cyanide for the deposition of Ag-Pt and Ag-Pd alloys is well established [3]. The basis of these approaches is that silver and several other metal ions form complexes in concentrated halide media and may be dissolved in suitable concentrations. To the best of our knowledge, deposition of Ag-Ni alloys from this medium has not been reported. The approach appears promising since chloride complexes with Ag ions are more stable than those with Ni ions, promoting co-deposition.

Linear sweep voltammeteries (LSVs) in the concentrated chloride medium (Fig. 1a) show a short diffusion plateau of Ag deposition, and a subsequent plateau of Ag-Ni deposition preceding H<sub>2</sub> evolution. Galvanostatic depositions produce compact Ag-Ni layers with globular microscopic morphology (Fig. 1b). Formation of metastable solid solutions is investigated. The achievement of this approach is the deposition of compact, sulfur-free Ag-Ni layers [2], from a "green" aqueous bath devoid of toxic species like thiourea or cyanide.



**Fig. 1:** a) LSVs for the deposition of Ag and Ag-Ni alloy from a conc. chloride medium; b) SEM image of a Ag<sub>30</sub>Ni<sub>70</sub> deposit obtained by constant current deposition.

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