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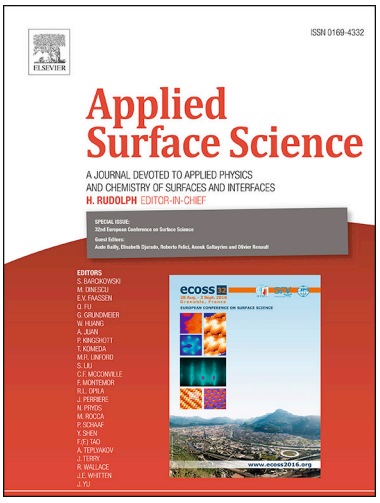

Full Length Article

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ELECTRODEPOSITION AND PROPERTIES OF BINARY AND TERNARY COBALT ALLOYS WITH MOLYBDENUM AND TUNGSTEN

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Electrodeposition of binary and ternary coatings Co-Mo, Co-W and Co-Mo-W from bi-ligand citrate-pyrophosphate electrolyte has been investigated. The effect of both current density amplitude and pulse on/off time on quality, composition and surface morphology of the galvanic alloys was determined. Current density increase up to 10 $A \cdot dm^{-2}$ has been established to lead to the higher content of refractory metals in all coatings at an acceptable process efficiency. The highest Mo and W content in deposits obtained at current density of 8–10 $A \cdot dm^{-2}$ with on/off time of 5–20 ms. Improvement in mechanical properties and corrosion resistance of ternary Co-Mo-W deposits when compared with binary and main alloying metals is driven by uniform surface morphology and chemical composition as well as by amorphous structure. The Co-Mo-W deposits with total Mo and W content of 15–20 at.% are the most catalytically active for electrolytic hydrogen evolution out of different media and can be comparable with platinum electrodes in this regard. These properties prospect such alloys as catalytic layer for cathode materials in hydrogen production. A significant increase in the microhardness of ternary alloys with respect to binary alloys is associated with structural features, surface morphology and phase composition.

Keywords: cobalt ternary coatings, molybdenum, tungsten, citrate-pyrophosphate electrolyte, catalytic properties, corrosion resistance, electrodeposition, hydrogen evolution reaction, pulse electrolysis, microhardness

Introduction

Development of new technologies and extending a range of thin-film functional materials predetermines interest in electrolytic alloys. Special attention is paid to the electrochemical deposition of iron triad Fe(Ni, Co) metals with d^4-elements Mo(W). Such coatings are well