

Enhancement and Inhibition of Partial Reactions in Alloy Deposition

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Electrodeposited alloys find many applications in the electronics, micromechanics and surface finishing industry. The successful introduction of through-mask plating of permalloy for the manufacturing of magnetic heads by Romankiw and coworkers has had a major impact on the computer industry and has led to a huge increase in the use of electrochemical technology in electronics manufacturing¹⁻³. On the other hand, the theory of alloy deposition is still less well developed, in spite of the fact that significant progress has been achieved since the epochal work of Brenner published in the sixties^{4,5}. Notably, the crucial importance of mass transport and of current distribution on the composition and the uniformity of electrodeposited alloys is widely recognized at present, although occasionally one still finds papers in the scientific literature in which these parameters are not controlled.

The composition of electrodeposited alloys for given experimental conditions depends on the kinetics of the partial reactions of the alloy components and of hydrogen. While for single metal deposition in the absence of additives kinetic expressions for the electrode reactions are readily obtained, this is not so for alloys because of mutual interactions between the reacting species at the electrode surface and/or in the diffusion layer⁶. Additive effects may further complicate the matter. Indeed, due to competitive adsorption phenomena at the electrode surface, the partial currents of codepositing metals can be larger or smaller than those expected from single metal deposition under otherwise identical conditions. The so-called anomalous codeposition and induced codeposition illustrate this well-known fact. In the present paper kinetic aspects and modeling of alloy deposition under dc and pc conditions will be discussed. More

specifically, the electrodeposition of nickel-iron alloys and the codeposition of molybdenum and of tungsten with nickel from model electrolytes will be considered based on published data and on recent results obtained in our laboratory.

References

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