

Influence of surfactants on bronze galvanic displacement on steel

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Deposition of thin Cu–Sn films on steel is needed to impart the wares temporal corrosion protection and to improve mechanical properties for molding, pressing, dragging, etc. The purpose of this work was to develop a cheap and high-speed method for Cu–Sn thin film deposition on steel from a stable and easily corrected solution. The most promising is the process of cementation or so called galvanic displacement proceeding in the absence of the external electric field and a reducing agent in the electrolyte. The main problems were to provide simultaneous copper and tin reduction with iron at a high rate and to guarantee stability of the bath against tin(II) oxidation and hydrolysis. We have solved these problems by developing an acid electrolyte containing small (less than decimolar) concentrations of Cu(II) and Sn(II) salts at their molar ratio of 90 : 1 and a surfactant such as sintanol DS-10 or sodium lauryl sulfate. In the absence of these surfactants tin was not included into the coating deposited on steel. Introduction of surfactants into the electrolyte provided tin co-deposition with copper and obtaining Cu–Sn alloy with 1–5 mass % of tin at a rate of 2.0–2.8 $\mu\text{m}/\text{min}$ that is only 10–30 % less than in the absence of the additive. Sintanol DS-10 or sodium lauryl sulfate effect the microstructure of the alloy films, diminish their porosity and stabilize the electrolyte.