MANGANESE COATINGS: TEMPERATURE INFLUENCE ON ELETROCHEMICAL DEPOSITION

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Manganese, as a chemical element, is utilized across various industries, particularly in the production of steel. Electrochemical deposition is a low-energy process, but the electronegativity of manganese limits this process. Enhancing the electrolyte with additional materials, such as selenium, sulfur, and tellurium compounds, has been shown to improve the efficiency of manganese electrochemical deposition [1]. Although the use of selenium and sulfur compounds have proved effective the drawbacks such as: selenium compound toxicity, sulfurs corrosive properties, leave more to be desired. Research on insertion of tellurium additives in manganese coatings is scarce and by that this research seeks to expand it [2]. The carbon steel (ASTM A283) plates were used as a substrate for electrodeposition of Mn coatings. For degreasing and etching the surface of carbon steel plates before electrodeposition process NaOH and HCl solutions were used, respectively. After each of these procedures, the rinsing with distilled water was applied. Electrochemical deposition was carried out in aqueous electrolyte containing the mixture of $MnSO_4$ and $(NH_4)_2SO_4$. The ammonium complexes in solution inhibit the formation of manganese hydroxides, resulting in denser and thicker manganese coatings [3]. Sodium tellurate (Na_2TeO_4) was used as an additive; pH of electrolyte was maintained between 2.30-2.35. During electrochemical deposition two anodes, coated with lead (IV) oxide (Pb/PbO_2), and polyvinylchloride (PVC) woven membrane, separating the anode and cathode compartments, were used. Deposition lasted for 7 minutes with a cathodic current density of 15 A/dm^2, at four different temperatures: 20, 40, 60, 80 °C.

Table 1. Current yeld and thickness of manganese coating depending on the deposition temperatures

Deposition temperature, °C	**20 °C**	**40 °C**	**60 °C**	**80 °C**
Current yield, %	58.1±4.7	65.6±9.6	72.1±7.4	86.1±5.9
Mn coating thickness, µm	9.9±0.8	11.6±1.7	12.4±1.3	14.8±1.0

References:

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