

Kinetic regularities of deposition of Fe–ZrO₂ (+3% Y₂O₃) composite electrodeposits

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Kinetics and mechanism of the electrodeposition process of Fe–ZrO₂ (stabilized by 3% mol. Y₂O₃) composite coatings from a methanesulfonate electrolyte are investigated in this communication. The content of stabilized zirconia in coatings increases with an increase in the ZrO₂ concentration in suspension and with a decrease in the cathodic current density. Kinetics and mechanism of particles co-deposition are shown to obey the Guglielmi's model. The value of the adsorption coefficient is calculated for the adsorption of zirconia particles on the iron surface. The rate of the ZrO₂ (+3% Y₂O₃) particles adsorption on the iron surface is sufficiently higher than the rate of desorption. The surface coverage of the loose adsorbed zirconia particles is more than that of the strong adsorbed particles. The surface coverage of the loose adsorbed ZrO₂ (+3% Y₂O₃) particles is shown to increase with an increase in the concentration of the dispersed phase in solution. The rate of the ZrO₂ particles co-deposition is controlled by the transferred process of loose adsorption to strong adsorption. The analysis of the experimental results based on the Guglielmi's theory demonstrates that the Fe(II) ions adsorbed on the zirconia particles surface discharge slower than the solvated Fe(II) ions.

Keywords: composite coatings; iron; zirconia; electrodeposition; kinetics; adsorption.

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