The effect of the electrolysis regime on the composition and morphology of Fe-Co-Mo(W) coatings

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The binary and ternary Fe-Co-Mo(W) coatings were formed onto a mild steel substrate from the Fe(III) based citrate electrolyte [1]. Electrodeposition was conducted using direct current regime with density i of 2–7 $A \cdot dm^{-2}$ and unipolar pulse mode with current amplitude *i* of 2–6 $A \cdot dm^{-2}$ at a pulse duration $t_{on} = 2 \cdot 10^{-3}$–$5 \cdot 10^{-2}$ s and pause time $t_{off} = 1 \cdot 10^{-2}$–$5 \cdot 10^{-2}$ s. The chemical composition of the coatings was determined by X-ray fluorescence method. The surface morphology of the deposits was studied by a scanning electron microscope ZEISS EVO 40 XVP and an atomic force microscopy using NT–206.

It has been established that the content of refractory metals in the coatings deposited at pulse mode reaches ω(Mo) = 18 at.% and ω(W) = 11 at.%. This concentration is higher than in deposits obtained by direct current of the same density: ω(Mo) = 12 at.% and ω(W) = 7 at.%. The AFM analysis show that the surface structure varies from fine-crystalline for coatings deposited at direct current to globular formed using pulse mode which is caused by increase in refractory metals content [2]. It should be noted the increase in the size of agglomerates on the surface of coatings obtained in the pulsed mode in comparison with galvanostatic one, moreover the grain sizes Fe-Co-W coatings are larger than Fe-Co-Mo. In addition, Fe-Co-Mo coatings are characterized by the presence of sites with a developed surface topography of which is identical to the crystal lattice of cobalt with the conglomerates sizes in the range of 0.2–1.75 μm [3].

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