Electrocrystallization Of Copper On Glassy Carbon: TheInfluence Of Various Methods Of Electrode Pretreatment On TheType Of Spatial Nycleus Distributions

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INTRODUCTION

Although many studies are devoted to initial stages of metal electrocrystallization, the influence of various electrode pretreatments on the type of spatial metal nucleus distributions is not quantitatively estimated. At the same time, it is known that the quality of thin electrolytical coatings depends on the method of substrate surface pretreatment. The purpose of this work is to investigate the effect of electrochemical, chemical and heat pretreatments on glassy carbon surface on the number density of copper nuclei and the type of their spatial distributions.

EXPERIMENTAL

Copper nuclei are electroplated on glassy carbon with potentiostatic or galvanostatic pulse from sulfate electrolyte. Inter-nuclear distances are estimated from the analysis of radial distribution functions of inter-nuclear distances and histograms of spatial distributions of average distances between the nearest neighbor nuclei taking into account copper nucleus size (1).

RESULTS AND DISCUSSION

It is found that both under potentiostatic and galvanostatic conditions of copper electrodeposition on glassy carbon, the number density of nuclei and the type of their spatial distribution essentially depend on electrode surface pretreatment. It is shown that depending on the method of substrate surface pretreatment, deposition potential and current density, the copper nuclei are distributed both evenly and non-uniformly on the glassy carbon surface. In the latter case, they are distributed statistically ordered on the surface. The ordering is obvious to virtue of the fact that specific inter-nuclei distances for which the value of Romanovsky's correspondence criterion $\psi_n \geq 3$ obey a geometrical progression with a ratio $q \approx 1.41$.

It is shown that the influence of the nearest neighbor nuclei determines the type of the spatial distribution of copper nuclei. Besides, the correlation in the mutual location of nuclei relates to the order of their formation. It is determined that maximal special internuclear distance characterizes the long-range order in nucleus distribution, which can be calculated as the sum of the average distances between the nearest neighbor nuclei. Under galvanostatic regime with the increase in number density of copper nuclei, the value of the relative deviation of the average distance between the nearest nuclei increases, while under potentiostatic regime it reaches its maximum. It is explained by the fact that under galvanostatic regime nuclei are formed under non-stationary conditions at the initial stages of metal electrocrystallization.

REFERENCES

1. T. Arzhanova and A. Golikov, J. Electroanal. Chem., **558**, 109 (2003).