ANN SIMULATION OF NANOCOMPOSITES Fe(Co)-W CORROSION RESISTANCE

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The problem of the formation of functional coatings, combining such important consumer properties as corrosion resistance, hardness, wear resistance and catalytic activity, is key in the creation of new materials for modern devices and technologies. The great practical interest in Co–W and Fe–W alloys is explained by the prospect of their use as thermo and wear resistant, magnetic-hard materials, possessing high microhardness and being an alternative to hard chrome coatings [1].

The common trends in the corrosion behavior of Co(Fe)-W electrolytic alloys in an aggressive media is a decrease in the corrosion rate with an increase in the refractory metal content. The corrosion resistance of tungsten alloys significantly exceeds the resistance not only of steel substrates, but also of individual metals [2]. To predict the corrosion resistance of the above alloys, thermodynamic functions of metals and their oxides, the energy and parameters of the crystal lattice, the specific electrical resistance of metals and oxides, etc., were used as input parameters for artificial neural networks (ANN) analysis. The output variable is the corrosion rate of the alloys in various environments. From the analysis of a large number of ANNs of various architecture, it was found that the minimal error in predicting the Co-W corrosion rate in aggressive solutions is achieved by a generalized regression ANN with two hidden layers. Simulation of the corrosion processes using ANN show the most important parameters determining the corrosion resistance of alloys to be electrical conductivity of metals and their oxides; metal-oxygen binding energy; standard enthalpies of formation and entropy of oxides WO_3, Co_3O_4, Fe_3O_4. The microhardness of coatings Co(Fe)-W of ω (W)=40–50 mas% rises up to 500–600, which allows to recommend such materials as an alternative to hard chromium coatings. This work was supported by al-Farabi Kazakh National University, Institute of Experimental & Theoretical Physics by AP05130069 project «Development of nanotechnology for the synthesis of functional galvanic coatings for electric devices».

References

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