INFLUENCE OF THE PROCESS COMPLEXATION OF TRANSITION METALS WITH HYDROGEN IN THE ELECTRIC DOUBLE LAYER ON OVERVOLTAGE OF HYDROGEN

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The purpose of this research is the improvement of the technology of the electrochemical reduction of Fe^{3+} ions to Fe^{2+} and Ti^{4+} to Ti^{3+} in the technological solutions of production of pigment titanium dioxide and crystalline titanium sulfate(III) (active reductant) with minimal power costs. Special attention is paid to the identification of factors influencing the hydrogen evolution overpotential to nd-metals with the aim of making them effective cathode, with maximum output current, low cost and high stability in sulfuric acid solutions.

Considered limiting electrolysis in order to fulfill the practical tasks of the electrochemical reduction of titanium(IV) to (III) (a strong reducing agent) . Analysis electrical resistivity nd^z-metals (n = 3–5) and hydrogen evolution overvoltage in solutions with a pH<7. At the same time, between the functional dependence, suggests that an important role in reducing the overvoltage of hydrogen is the process of chelation hydrogen compounds (H^0, H^-) with a metal having a high energy absorption. It is found that elements having the configuration nd^{10} not participate in the processes of complexation , due to the absence of free d-orbitals therefore have a low energy hydrogen adsorption, hence are metals with high hydrogen evolution overpotential. It is found that the best materials for cathodes used in acidic media to be applied nd-metal alloys with empty d- orbitals. It is necessary to take into account the cost of metals, especially $5d^z$ and $6d^z$. Based on studies, we recommended to use in sulfuric acid solutions of metal alloys $3d^z$-sublevels : Cr, Mn, Fe, Co, Ni. From $4d^z$ it proposed to use metal polymetallic steel (stainless).

Keywords: complexation, hydride ion, nd^z-elements, overvoltage, electrolysis, hydrogen recombination, electrical double layer, the resistivity of metals, the current efficiency.

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