

CHARGE TRANSFER IN SEMICONDUCTOR POLYOXIDIC SYSTEMS WITH FRACTAL STRUCTURE

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Development of supersensitive systems of early detection of the center of ignition of the combustible materials (CM) for the gas fire of detector (GFD) is an actual problem of ensuring fire safety of buildings and constructions. Earlier by us it is established that only semiconductor (SC) sensors can be used at the same time for identification of products of pyrolysis and control of change of concentration of fire-explosion safety and toxic gases. Therefore in work it is offered to use as the sensitive element (SE) for GPD – the sensor about semiconductor sensitive element (SCSE) of the helicoid type (HT) created on the basis of available and cheap materials (SnO₂, In₂O₃, Al₂O₃, TiO₂), without use of precious metals (Pt, Ru, Au, etc.) as catalysts of adsorption of molecules of gases.

The model of conductivity of similar gas-sensitive sensors is based on representation that the sensors possessing high porosity, are considered as disorder system of oxidic clusters of nanometric scale therefore in such structures there are no concepts of a zone of conductivity and a valent zone that is very close to model of "hopping" conductivity. From here the assessment for conductivity is received and the relative increase in conductivity of a SE of SCSE HT is found at adsorption of molecules of gas.

By calculations it is established that conductivity of a SM sharply (as double indicative function) increases with increase in fractal dimension of CS.

Nature of dependence of relative increase in conductivity of SCSE HT from change of its fractal dimension (ΔD) will well be coordinated with results of experiment. It is shown that at reduction of fractal scale (the sizes of clusters) δ sensitivity of SCSE HT on concentration of gas and on time of reaction of adsorption increases.

THE CORROSION AND ELECTROCHEMICAL DISSOLUTION OF ALLOYS OF ALUMINIUM AND IRON IN BATH OF ELECTROLYTES B HYDRODYNAMIC MODE

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The purpose of researches is establishment of regularities of dissolution of metals in the conditions of an intensive mass transfer of reagents and products in an interphase layer and a role of these processes on the speed of chemical dissolution of alloys. Results of experimental studies:

1. In solutions H_2SO_4 of various concentration, with addition in these solutions NaCl, NaAc, $Pb(Ac)_2$, in the range $\omega = 0 - 1500$ rpm of dissolution of AD-0 and AMZ it isn't established.

2. In alkaline solution (NaOH) with additives NaCl, $Na_2S_2O_8$, NaAc, process of spontaneous ionization is carried out in a wide interval of values ω that is connected with acceleration of process of a complex formation soluble drop-shape - $[Al(OH)_4]^-$ particles. In all experiments with AD-0 and AMZ in various alkaline environments it isn't established even partial transition of system to the HDRS mode. It is quite possible that the speed of delivery of an oxidizer is connected with its small mass which increased by transition to research of reactions of a contact exchange on the basis of Fe/CuSO₄, H₂SO₄, H₂O system.

3. For Steel type 45 in 0,1M HCl solutions, with additives NaCl, $Na_2S_2O_8$, $(CH_2)_2(OH)_2$, (EG) is established that in all solutions dissolution speed (V) with increase ω in a sample increases. In 0,51M NaCl solution value V, on the contrary, isn't enough in all range ω and is close to zero. At introduction in solution 0,1M HCl of additives 0,51M NaCl + 0,1M $Na_2S_2O_8$ the speed of etching of steel 45, with increase ω , increases much.

4. Research of Steel45/CuSO₄, H₂SO₄, H₂O systems showed that with increase in concentration Cu^{2+} - ions with 0,1 to 0,5M dependence (V – ω) passes through a maximum, then decreases and comes to a plateau. It follows from this that processes of a chemical contact exchange on a Fe-alloy in sour environments, in the conditions of strengthening of hydrodynamic impact on an interphase zone, are accompanied by the effect of partial manifestation of effect of hydrodynamic restriction of speed (HDRS-effect).

HYDRODYNAMIC EFFECT IN HETEROGENEOUS ELECTROCHEMICAL SYSTEMS

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Essence of effect of hydrodynamic restriction of speed of chemical reduction of metals (HDRS-effect that on dependences “deposition speed (V_{Me}) – the speed of rotation of a sample (ω)” after achievement of a maximum happens the subsequent decrease V_{Me} (to increase ω) up to zero (the territory 1, fig. 1). Specifics of interphase processes of chemical reduction on various mechanisms and products of reaction has decisive impact on character – therefore only partial demonstration of HDRS-effect can take place (fig. 1, curve 2).

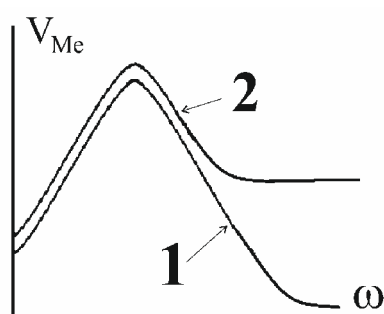
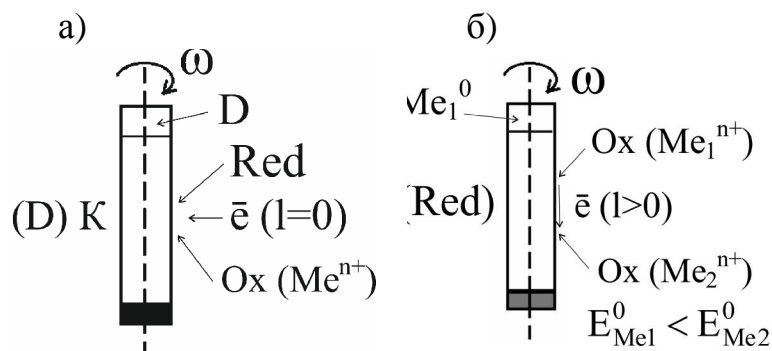


Fig. 1 – type $V_{Me} - \omega$ with full (1) and partial (2) HDRS-effect demonstration



1. Red - $n\bar{e} \rightarrow O_x$
2. $Me^{n+} + n\bar{e} \rightarrow Me^0$

Fig. 2 – Diagrams: a) chemical reduction Me^{n+} on surface catalytic (K); б) chemical dissolution Me_1^0 in bath with Me_2^{n+}

The physical and chemical nature of model of processes of chemical reduction (according to diagrams – fig. 2 a, b) in the conditions of HDRS-effect is established on the basis of systematic calculations kinetic (V_{Me} , $\tau_{1/2}$), physical (F_{bf} , F_{cf} , q) and hydrodynamic (Re , Te) factors. Results of calculations showed that the effect of HDRS is connected with demonstration of effect of pushing away of reaktionsnoaktivny particles (Ox and Red) from a sample surface, when performing conditions: $F_{cf} > F_{bf}$, $\tau < \tau_{1/2}$.