ABOUT A ROLE OF ALLOYING COMPONENTS ON PROCESSES OF HYDROGEN DIFFUSION IN ALLOYS DEPENDING ON THE NATURE OF ALLOYING ADDITIVES

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Introduction

According to given experimental works on studying of structural formations of nickel with alloying components [1] alloys on its basis differ not only physical and chemical and physicomechanical characteristics, but also can dissolve with various activity in itself hydrogen.

Thus it is necessary to mean, that absorption of hydrogen by metals influences not only the nature of an alloying component and its concentration in nickel, but also ability of this element directly to co-operate with hydrogen. In our opinion and on the basis of results spent before researches it is possible to formulate the basic conclusions by possibilities of formation of connections Me-N in electrochemical systems: 1) the probability of formation of connections Me-N that more than is more concentration of defects in structure on volume unit; 2) the quantity of the dissolved hydrogen depends not only on electronic structure of an element and specific parities of parametres of a crystal lattice of metal (Pd, Pt, Ni), but also from conditions of formation of structure of the metal absorbing hydrogen; 3) on interaction of hydrogen with metal can have stimulating influence some kinds of fields, for example, ultrasonic, thermal, electromagnetic.

Results and discussion

In the theory of hydrogen interaction of hydrogen with metals [2] there is a concept about presence of "a hydrogen blank" for transitive elements of the fourth period. However in work [3] it has been established, that at electrochemical formation of chrome there is possible an existence hydride phases in structure restore on cathodic metal. This circumstance allows to assert, that the probability of formation of hydride compounds for such way of formation of metal increases for two reasons: 1) presence of the atomic hydrogen caused by one of possible stages of total electrochemical process; 2) presence in structure of metal of zones with high energy potentials (defects of structure).

Generally the quantity of the dissolved hydrogen in metal can be defined from expressions

$$V_{H_2} \equiv (m_{\text{мет}}/\rho_{\text{ме}}) \times N_A , \qquad (1)$$

$$V_{H_2} \equiv V_{\text{ме}} \times N_A \times k_{\text{л}} \times k_d \times k_i , \qquad (2)$$

where N_A – constant Avogadro; $k_{\text{л}}$ - the factor depending on influence of external fields on process of formation of connections Me-N; k_d - the factor of defects considering number образуемых of defects on unit of volume; k_i - factor of recalculation of volume of metal in nuclear weight according to number N_A.

To use formula (2) for analytical definition of quantity of the dissolved hydrogen rather difficult. However it reflects all phenomenology of process of interaction of hydrogen with metal at its electrochemical restoration.

For the description of behaviour of hydrogen in metals it is the most convenient to use a method of the internal friction, allowing to make an estimation of processes of interaction of hydrogen with metal in a wide interval of temperatures. Thus, the analysis of temperature dependence of an internal friction allows to define the hydrogen which is in any phase condition (solid, liquid, gaseous). For example, by means of this method it was possible to find out the gaseous hydrogen passing to the solid state at T = 17 K, and the peak of an internal friction corresponding to him (its amplitude) has allowed to establish quantity of molecular hydrogen [4]. Other methods such transitions to define it is not possible. The basic advantage of a method of an internal friction is measurement of energy of activation in the course of hydrogen diffusion by experimental definition of semiwidth of peak Snuka characterising process of diffusion of hydrogen in the sample at certain temperature. Not pressing in detail in a design procedure, we will specify only that for nickel the size of energy of activation corresponds to its condition in hydride to form [5].
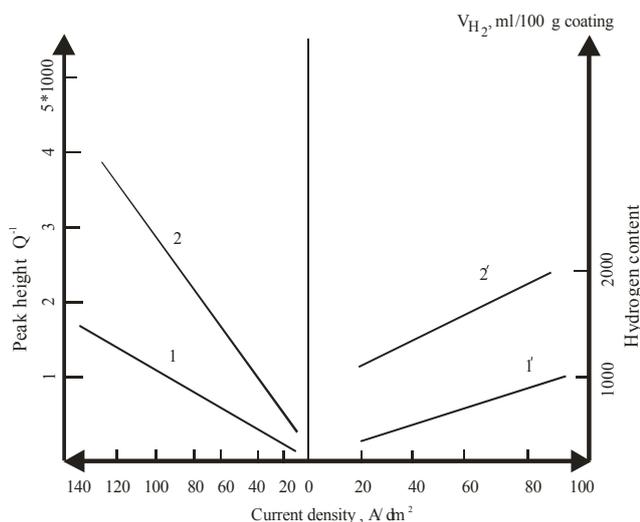
Fig. 1. Dependence of height of peak of an internal friction and the hydrogen maintenance (V_{H2}) from density of a current for chromic samples received in standard (1) and sulphate (2) electrolytes.

From data of Fig. 1 and Fig. 2 it follows, that the nature of electrolyte and current density makes the main impact on the hydrogen maintenance in electroplating. Most likely it is possible to explain it distinction in mechanisms of formation of chrome in solutions of chromic acid and chrome sulphates (Fig. 1). The interrelation of quantity of the hydrogen dissolved in metal with i_k speaks increase in number of defects in structure of metal with increase i_k. The similar phenomenon is observed and for dependences $Q^{-1} = f(i_k)$.

For other metals such laws should remain, but thus can change as absolute indicators under the hydrogen maintenance, and on amplitude of peak of an internal friction. It is necessary to notice, that peak position on a temperature axis and its semiwidth defining energy of activation of process of diffusion of hydrogen, can change under other laws.

From i_k for Ni (fig. 2) it is possible to explain inadequate change of maintenance H₂ only lacks of a method of definition, namely at vacuum экстракции the hydrogen part appears not extracted (not taken) of traps and consequently the real picture can be received only at use of methods of vacuum fusion or an internal friction.
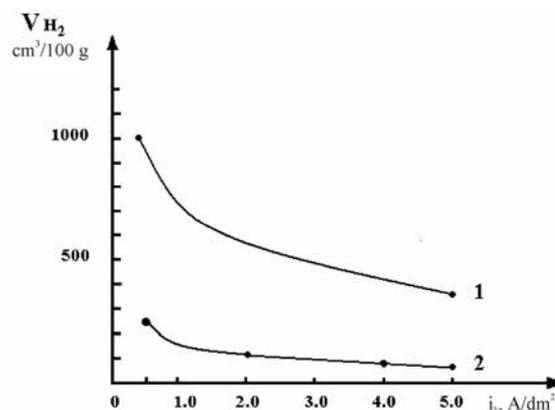

Fig. 2. Dependence of the maintenance of hydrogen (V_{H2}) from density of a current for the nickel samples received in sulphatic (1) and sulphamate (2) electrolytes (d = 4 microns).

Conclusions

Thus, the condition of hydrogen and thermodynamic parametres of processes of its transition in various phases at interaction with metals is necessary for investigating the structurally-sensitive methods excluding influence of nuclear weights on processes of research.

Influence of separate components (and i_k) on processes of diffusion of hydrogen can be considered a chemical compound of electrolyte as the primary factors defining processes of interaction of hydrogen with metal.

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