Quasi-static teaching and teaching of quasi-static

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Continuity break of fundamental knowledge causes unreliability, formality of mental embedding and logic structurization of the with these knowledge connected information. It may be acquired (assimilated) only that information which contents even approximately corresponds to internal individual structures [1]. We shall consider one of such breaks and ways of its elimination by the example of electrolysis process.

The classical electrochemical system includes at least two electrodes, immersed in electrolyte [2]. The greatest difficulty for students is physical essence understanding of the processes proceeding on an electrochemical circuit section. It is connected, in particular, with a change of the charge carriers nature at an electrode surface. The system analysis shows that it will be expediency to reduce the electrochemical cell (working in a electrolyse mode to the conductor with electronic conductivity immersed in electrolyte. If one gets over the electrolyte splitting voltage on the conductor it is possible to observe in area of waterlines course of electrochemical processes. Within the framework of quasi-static approach the research beginning of object should lay in its stationary (it is even better in equilibrium) condition.

For reception of the predicted response, it is necessary to act on object very small signal [3], in our case – to give the small voltage concerning equilibrium value. Increasing the voltage one can observe occurrence of additional effects that testifies to a getting over quasi-static limits. Such way of system consideration is in a plane of the thermodynamic formalism.

At an getting over of quasi-static frameworks the system starts to differentiate quantity of influence on the basic, perceived by system quasi-static, and additional which number and sort become more and more unpredictable with increase of influence. All additional quantities of influence can be attributed to the category phantom, transmitted to system under action of phantom potentials. Corresponding interactions have been excluded on conditions of isolation, however there were changes of the connected coordinates of a condition that has resulted, in turn, for complex processes of an exchange with an environment. In our case all effects, except for electron moving of conductor in an electric field, are caused by action of phantom potentials. Really, thermal interaction was absent but internal energy of system has increased for some size TdS, electrochemical transformations of substances testify to change of the coordinate describing quantity of substance in a phase, thus internal energy changes on some size μdn, where μ – electrochemical potential, dn – elementary change of quantity of substance. The specified processes cause, in turn, transport streams in volume of electrolyte (diffusion, migration, convection) as consequence of electrode reactions.

The second measure of didactic space is psychological. Quasi-static approach in this measure assumes splitting of cognitive process into a line of elementary acts. The beginning of this process should be located in the stationary condition corresponding to well acquired base representations about the investigated phenomenon or object. The wide application of the elementary toys and demonstrations, in particular, at studying physical laws is in the consent with this approach. The infringement of physical quasi-statics results in complication of system and infringement of psychological quasi-statics can lead to inadequate peception and to various complications

in didactics: to the lowered attention, the irritability, increased or lowered self-estimation, a conflictness in mutual relations with the teacher etc. In the considered example the psychological continuity is caused by a lot of the aspects inherent in used physical model. Among them: basing on well known of a school rate the law of Ohm, consideration of all phenomena as derivatives of one potential of interaction of a put voltage, use of the phenomenological approach to the analysis of behavior of the system, allowing to abstract from complex mechanisms of proceeding processes… The quasi-static approach to statement and carrying out of physical experiment allows to reveal the multilevel organization of object, with use of the minimal equipment to realize a wide spectrum of demonstration opportunities. Besides using principles of similarity by logic formalization it is possible to expand any system up to the ecosystem level, than to stimulate the student to comprehension of the responsibility for consequences of realization of technical decisions, for consequences of acts in the widest sense of a world, to stimulate to development of the weighed behavioral strategy.

References

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