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Movement as a bifurcation way of the transition of oxyhydrate systems to chaos

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Abstract

In the present article, experimental data are considered – spontaneous currents in rare earth oxyhydrates. The data considered are compared with the van der Pol oscillator, and on the basis of the comparison it is concluded that the current of the Stern-Gui layers and the oscillator currents are similar. Further consideration of the chaotic nature of current oscillations by means of averaging leads to conclusions about the stability of the "average oscillation" and its increasing chaos. The considered chaotization, in the opinion of the authors, will have a very significant effect on the chemical reactions in the colloid. A potential difference (approximately 0.2 Volts) arising between electroconducting electrodes placed in a colloid, for example, rare metal oxyhydrate and connected to one another through a measuring instrument, arises and goes to nanoelectrodes ranging from several nanoamperes to microamperes. This circumstance is the most important characteristic of a substance that determines its cluster formation and fine structuring in time.

The formation of synchronized spiral waves in the cells of colloids of d- and f-elements, namely, their DELs, which initiate the flow motions of ion-cluster formations, is established, and this system can be represented by interacting Van der Pol oscillators.

Due to the flow of motion of ion-cluster Formations of gel oxyhydrate systems revealed the phenomenon of their intermittency as one of the possible scenarios of transition to chaos. In this case, there is a change in the trains of some oscillations by others, and eventually the process becomes completely chaotic. In this case, the processes of doubling the Feigenbaum oscillation period are observed. The transition of quasiperiodic oscillations to chaos is similar in many respects to the transition through quasiperiodic motions to. In a discrete system, an invariant two-dimensional torus corresponds to three-frequency quasiperiodic motions.

Chaotization from the point of view of mathematics occurs if the process oscillates between several such points, and these stationary points (points of chemical equilibrium) are unstable. Each of the points corresponds to a balanced chemical quasiequilibrium in the zirconium oxyhydrate system, and switching between points corresponds to a situation where balances are destroyed, and one process suppresses the other, and then gives way to the third. At the same time, a stable quasi-equilibrium process can suddenly become non-equilibrium because of a change in the parameters of the system, that is, with bifurcation. For example, the processes of hydration can compete with the growth of the polymer chain. For monomers, the trihydrate form ($ZrO(OH)_2{\cdot}3H2O$) should be the highest concentration in solution, for other clusters the amount of water in the hydrate shell is different. As the chain length increases, its instability increases many times, which greatly increases the probability of relaxation of the metastable state, that is, chain destruction. At a certain length of the polymer chain, it breaks. As a result, the two resulting fragments are more stable and can continue to grow again. In the case of a lack of monomers in solution, the chain growth will continue due to isothermal distillation of less stable chains into more stable ones. Thus, the successive growth of chains and their discrete destruction ensure a temporary periodicity of the properties of the gel.

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