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Structural features of colloids of *d*-elements of oxyhydrate

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Abstract

In this paper, their geometric structures are determined on the basis of the optical properties of the oxyhydrates of the d- and f-elements and the measurements of the free currents generated by the colloid. The randomness of the oscillations of the colloid current appears to be associated with the deformation of colloidal structures constructed from long polar molecules. The transition of current bursts to chaos through intermittency appears to be part of the process of destroying some of the colloidal structures (Liesegang clusters) and the formation of new parts and clusters.

Consideration of the assumed behavior of the colloidal gel can be used to take into account the change in the concentration of the matrix-forming colloid of the element, the "diffusion-reaction" equation, taking into account the Liesegang operator: $\frac{\partial n}{\partial t} = D\Delta n + L[n]$ where n – is the concentration of the substance, D – is the diffusion coefficient, Δ – is the Laplace operator, $L[n]$ – is the Liesegang operator assumed $+\alpha n$, the concentration has reached a lower value $u_{\min}$, or $-\alpha n$, if the concentration has reached some upper value $u_{\max}$, α – a certain positive number.

The solution of the problem for the Liesegang operator in spherical coordinates is known: $n = n_{\min}\frac{R}{r}\frac{\sin\left(r\sqrt{\alpha}\right)}{\sin\left(R\sqrt{\alpha}\right)}$. In order for the condition to be satisfied $n\big|_{r=0} = n_{\max}$, it is necessary to satisfy the relation $n_{\max}\sin\left(R\sqrt{\alpha}\right) = n_{\min}R\sqrt{\alpha}$. Thus, knowing from the experimental data the α-frequency, $n_{\min}$ and $n_{\max}$, we can determine the geometric size of the cluster area – its radius.

The colloid is represented by long polar macromolecules. Consequently, the electric moment – the polarization vector $\vec{P}$ of these molecules, numerically equal to the electric field, is related to the concentration by the formula $n = div\,\vec{P}$. Thus, the Liesegang operator also obeys the equation for polarization, or rather, the electric field, which is closely related to polarization.

Further, macromolecules interacting with each other form an angle. This means that the inhomogeneities on which diffraction of light will occur have a spiral twist, which coincides with experiment.

The electric interaction will also affect individual charged clusters, which determine the movement of free charge by their volume. It is easy to see that the equation of motion of these free particles will obey an equation similar to the van der Pol equation. However, from an analysis of the van der Pol equation it follows that the vibrations of free particles are randomized with time.

Oscillations of free mobile fragments-clusters will also affect larger fragments. The front of formation of the next Lizegang cell – that is, the layer between the regions of different signs – changes or deforms, that is, the spiral "unfolds" or "folds", it is even possible that the sign of the Liesegang operator changes. All this

will lead either to fluctuations in the size of the cluster area, or to its rupture and isolation of a separate cluster that has its own operator.

Consequently, experimentally observed oscillations of the cluster size can be correlated with the oscillations of the front of the operator, and increasing chaotization through intermittency can be compared with discontinuities of individual cells and dissolution of separated fragments or the formation of a new cluster around them.

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