

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

© Yury I. Sukharev,^{1*} Inna Yu. Apalikova,² and Boris A. Markov³

¹ Chelyabinsk State University. Brothers Kashirinykh St., 129. Chelyabinsk, 454001. Ural Federal District. Chelyabinsk Region. Russia. E-mail: Yury_Sukharev@mail.ru.

² Chelyabinsk Higher Military Aviation Red Navy School of Navigators. Branch of the Military Educational and Scientific Center of the Air Force "The Air Force Academy Named After Professor N.Ye. Zhukovsky and Yu.A. Gagarin "(Chelyabinsk). Gorodok-11, 1. Branch of VUNTS VVS "VVA". Chelyabinsk, 454015. Russia.

³ Federal State Autonomous Educational Institution of Higher Education "South Ural State University (National Research University)". pr., Lenin, 76. Chelyabinsk, 454080. Russia. E-mail: smpx1969@mail.ru.

*Supervising author; [†]Corresponding author

Keywords: emission-wave duality, Lagrange mappings, Liesegang operator, multipoly, oxyhydrate gel systems, colloid clusters, spontaneous pulsation flow, diffuse double electric layer, topological continuum, dissociative-disproportional mechanism, Whitney theory, caustic geometry, noise states.

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: $n = n_{\min} \frac{R \sin(r\sqrt{\alpha})}{r \sin(R\sqrt{\alpha})}$. In order for the condition to be satisfied $n|_{r=0} = n_{\max}$, it is necessary to satisfy the

relation $n_{\max} \sin(R\sqrt{\alpha}) = n_{\min} R\sqrt{\alpha}$. 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 $n = \text{div} \vec{P}$. 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 Liesegang 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

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.

References

- [1] Yu.I. Sukharev, B.A. Markov. Noise pulsations in oxyhydrate systems. *Publishing house of the CSU*. **2012**. 164p. (russian)
- [2] F.M. Shemyakin, P.F. Mikhalev. Physicochemical periodic processes. *Moscow-Leningrad: Academy of Sciences of the USSR*. **1938**. 185p. (russian)
- [3] Yu.I. Sukharev, B.A. Markov. Nonlinearity of gel oxyhydrate systems. *Izd-vo UB RAS*. **2005**. 468p. (russian)
- [4] A.M. Il'in, B.A. Markov. *DAN*. **2011**. Vol.440. No.2. P.164-167. (russian)
- [5] V.V. Avdin, Yu.I. Sukharev, T.V. Mosunova, N.S. Shirshova. *Izv. ChNC UB RAS*. **2002**. Iss.3. P.73-78. (russian)
- [6] B.A. Markov, Yu.I. Sukharev, A.I. Kurdyukov, I.Yu. Apalikova. Energy and electromagnetic processes in open systems with the participation of associates and colloidal clusters. Part 1. The polarization of gels and colloidal optical diffraction in oxyhydrate, as well as streaming cluster spectroscopy. *Butlerov Communications*. **2016**. Vol.45. No.1. P.56-75. DOI: 10.37952/ROI-jbc-01/16-45-1-56
- [7] J. Dudel, J. Ruegg, R. Schmidt et al. Physiology of man. Vol.1. *Moscow: The World*. **2007**. 323p. (russian)
- [8] Yu.I. Sukharev. Wave properties gel colloids as a cause of cluster splash. *Butlerov Communications*. **2016**. Vol.47. No.7. P.125-160. DOI: 10.37952/ROI-jbc-01/16-47-7-125
- [9] Yu.I. Sukharev. Electromagnetic noise entangled states of cluster colloidal systems. *Butlerov Communications*. **2016**. Vol.45. No.1. P.1-41. DOI: 10.37952/ROI-jbc-01/16-45-1-1