

## Finsler-Lagrange kinetic model of Langmuir monolayer structurization

N.G.Krylova, H.V.Grushevskaya

*Belarusian State Agrarian Technical University, Minsk; Belarusian State University, Minsk*

A Langmuir–Blodgett technique is the promising method to fabricate the ultrathin nanostructured films of two-dimensional (2D) materials which are in great demand for microelectronic, optoelectronics, nanophotonic and biosensor applications. In comparison with the other assembly methods the technique is featured by controllability of the process, as well as by the reproducibility and quality of assembled films. The formation of monomolecular layers (Langmuir monolayers) of organic amphiphilic molecules occurs on the interface liquid subphase/air in a result of a 2D phase transition of the first order from the liquid expanded state to the liquid crystal one. To date, there is no a comprehensive model of the 2D first-order phase transition in the Langmuir monolayer. One of the problem faced the Langmuir-monolayer-structurization description is the complexity to account effects of the subphase. In present work we develop the previously proposed Finsler-Lagrange geometrodynamical model of the first-order phase transition in the Langmuir monolayer. This approach takes into account the electro-capillary phenomena on the interface and the relaxation-time distribution of phase nuclei [1-3]. We have shown that the nucleation rate depends nonlinearly on the level of supersaturation of the system. At low monolayer compression rates the nucleation rate is practically constant and the free energy has an only local minimum. At high compression rates when the energy and rate are enough to overcome nucleation energy barrier, the Langmuir monolayer state becomes supersaturated one. In this case the formation of the phase nuclei with sizes much more than critical one occurs due to the appearing of the additional local minimum in the free energy. Meanwhile the additional Jacobi unstable region exists during the phase transition, the second minimum corresponds to the stable state of the system in the Jacobi sense.

### References

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