Nanoscale physics

Effect of the irregularities on the surface on the its interaction with the virus (nanoparticle)

N.M. Rusinchuk, V.Z. Lozovski, M.A. Razumova

Institute of High Technologies, T. Shevchenko National University of Kyiv, Volodimirska str.56, Kyiv, 01601, Ukraine.
E-mail: n.m.rusinchuk@gmail.com

The possibility of irreversible transformations in the virus structure caused by the action of rather strong local field was demonstrated both in experiments [1, 2] and theoretically [2-4]. In this case the virus infectious activity is inhibited by strong local field action on virus receptors located on its capsid.

Thus, it is necessary to study the systems that can allow one to obtain this phenomenon. Such is the virus located close to the solid surface with the excited surface plasmon. Here the intensified local field is caused by the local field enhancement effect. The interaction between the virus and a flat solid surface has been studied theoretically in [4-5] from the physical point of view. But the effect of the surface structure on this interaction has not been studied yet.

Hence, we study the interaction in the system "virus-nanostructured surface" and its dependence on the parameters of the surface structure. In the model the virus is considered as a nanoparticle, the interaction between the virus and the surface is considered to be caused by the Kazimir forces, the local field approach was applied, and the local field inhomogeneity inside the virion is taken into account.

It has been revealed, that the binding energy in the system strongly depends on the length and height of the irregularities on the surface, and on the relative position of the virion and the edge of the irregularity. Furthermore, the binding energy value in the system with the flat surface is considerably smaller than the one in the system with the nanostructured surface.

The described and studied effect can be used, for example, for purification of bioliquids from viruses and nanoparticles, or for inhibiting the virus infectious activity.

1. *Mazurkova N., Spitsyna Y., Shikina N., Ismagilov Z., Zagrebel'nyi S., and Ryabchikova E.* Interaction of titanium dioxide nanoparticles with influenza virus // Ross Nanotechnol. - 2010. - **5.** - P. 417-420.

2. *Lysenko V., Lozovski V., Spivak M.* Nanophysics and antiviral therapy // Ukr. J. .Phys. 2013. - **58**, N 1, P. 77-90.

3. *Lozovski V., Lysenko V., Piatnytsia V., Scherbakov O., Zholobak N., Spivak M.* Physical Point of View for Antiviral Effect Caused by the Interaction Between the Viruses and Nanoparticles // J. Bionanosci. - 2012. - **6**, P. 109–112.
4. *Kysylychyn D., Piatnytsia V., and Lozovski V.* Electrodynamic interaction between a nanoparticle and the surface of a solid // Phys. Rev. E - 2013. - **88**, N 5, Article ID 052403.
5. *Lozovski V. and Rusinchuk N.* Effect of the virus shell parameters on the interaction in the system "virus-surface" // 2015 IEEE 35th International Conference on Electronics and Nanotechnology (ELNANO-2015), Conference Proceedings. - 2015. - P. 321-324.