Nanochemistry and biotechnology of nanocomposites and nanomaterials

Synthesis of capped $A^{II}B^{VI}$ nanoparticles for fluorescent biomarkers

G.Yu. Rudko[1], V.I. Fediv[2], I.S.Davydenko[2], E.G. Gule[1], O.I.Olar[2], A.O. Kovalchuk[1]

1 V. Lashkaryov Institute of Semiconductor Physics of National Academy of Sciences of Ukraine, 45, Pr. Nauky, Kiev, 03028, Ukraine.
E-mail: . g.yu.rudko@gmail.com

2 Department of Biophysics and Medical Informatics, Bukovinian State Medical University, 42 Kobylyanska st., 58000, Chernivtsi, Ukraine

In the past decades, considerable progress have been achieved in designing novel tools for biomedical diagnostics by combination of colloidal particles with biomolecules or cells. There are still a lot of challenges to be overcome in this field. For example, interaction of "bare" nanoparticles (NPs) with biological objects can lead to their degradation or de-activation, exchange reactions on the surfaces of semiconducting NPs can hinder the formation of stable bio-conjugates and stimulate NPs aggregation and/or precipitation as well as diminish the efficiency of NPs luminescence. All these factors, augmented by the demand of bio-compatibility, impede applications of NPs for visualization and identification of organic molecules and cells. Thus, the challenge is to engineer the NP's surface conditions that eliminate the above shortcomings of "bare" NPs.

We report on the synthesis of $A^{II}B^{VI}$ NPs with different absorptive layers on their surfaces that can be used for bio-medical studies either *in vitro* or *in vivo*. The NPs surfaces were enveloped with different capping species, namely, the molecules of surfactant cetyltrimethylammonium bromide, macromolecules of polyvinyl alcohol, polyvinylpyrrolidone and gelatin, and the influence of these capping agents on the photoluminescence spectra (as well as on the visual color of the emission) was analyzed. The applicability of the capped NPs for *in vitro* luminescence visualization of biological tissues structures (histological specimens of the human placenta and histological liver specimens of dead fetuses and newborns) and washed human erythrocytes as well as *in vivo* luminescence visualization of living cells of lipocyte have been proven. The stability of samples dyeing by NPs and traditional dyes was compared, and much better photostability

of NPs was demonstrated.