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Optical nanosensor based on light scattering: Physical principles and applications for medical diagnostics and food control

Optical sensors based on size and shape change the functionalized nanoparticles (NP) due to interaction with the analyte are considered. NP's are functionalized by antibodies and in the case of presence of the specific analyte in the solution aggregation or shell formation process occurs. The change in particle size caused by these processes is controlled using dynamic light scattering (DLS) or resonance light scattering (RLS) spectroscopy. Both optical methods are available and non-invasive. Such techniques have several advantages in comparison with the conventional immune-chemical analysis–they are washing-free and time-saving. For medical applications nanoparticles sizing in blood plasma is required, for this purpose depolarized light scattering helps to distinguish light scattering of conjugates from the scattering of plasma proteins. The model describing the kinetics of functionalized NP size increasing was developed and applied for the optimization of nanosensor parameters (material, size, shape and concentration of NP). Experimental results on DLS based nanosensor for the disease markers and food contaminants are presented. New DLS instrument and data processing algorithms developed for applications with optical nanosensor gives the additional opportunities–non-spherical NP sizing using multi-polarization DLS, estimation of NP number concentration and, subtraction of the background NP size distribution.

Biography

Alexander Levin is Leading Research Scientist of the All-Russian Research Institute for Optical and Physical Measurements. He received PhD in Experimental Physics in 1981, he worked in various scientific and managerial positions in the field of laser methods of diagnostic, physical optics, developing of analytical spectral instruments for atomic and molecular spectroscopy, photon correlation spectroscopy. Since 2007 he is Doctor of Engineering Science, head of the scientific group, developing optical methods and instruments for nanoparticles characterization. Dr. Levin currently manages the projects on optical nanosensors and development of reference materials for fluorescence. He is the author and coauthor of the 3 monographs, over 80 scientific publications and 10 inventions. He has given many lectures at various national and international scientific conferences.

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