The main objective of the project is to establish the scientific basis to understand the mechanism of the formation of polyelecytrolyte – lipids films with embedded nanoparticles. As nanoparticles quantum dots (QD) with size ranging from 2.7 nm to 5.4 nm will be used. Development of conditions for creating liposomes of controlled stability containing hydrophobic quantum dots is also a new scientific issue of practical significance. Quantum dots are characterized by a broad excitation wavelength range, narrow and symmetric emission spectrum and higher stability than traditional fluorescent organic molecules. Since their hydrophobic surface results in an unfavorable toxicity profile, introducing serious limitations to the potential biomedical and clinical applications of QD, incorporation of quantum dots into amphiphilic compounds allows eliminating this limitation.

The most important stage of this project will be the optimization of conditions for the creations of liposomes as nanocarriers for hydrophobic quantum dots. Additionally, the adsorption of liposomes with embedded hydrophobic nanoparticles on multilayer films will be studied. The next step of research will include the analysis of the structure of modified lipids after deposition.

Creating functional nanocomposite films and determination of the influence of the structure and their properties on their functionality is the scientific problem of great importance for the development of the field of nanomaterials. Considerations of issues of deposition of hydrophobic nanoparticles in the hydrophilic film will develop strategies for the design of composited with any nanoobjects.

Determination of conditions for the incorporation of nanoparticles into the structure of multilayer films and investigation of the mechanism responsible for organizing the nanoparticles inside them will enrich significantly the basic knowledge about such complex structures. They will be also meaningful from a practical point of view because they will widen the range of hybrid materials in terms of desired physicochemical properties and their practical applications in technology-based systems. Complex hydrophilic polyelectrolytes-hydrophobic particles systems are very promising in that area, which makes them interesting from both scientific and implicational points of view.