Subproject 3 "Nanomaterials and nanotechnologies"

Goals of this subproject are to develop and receive innovational materials for optics, optoelectronics and sensors. It is aimed at applying a new engineering molecular technology and micro – and nanostructuring to develop new specific properties and materials of high characteristics. The project consists of two points; studies of carbonic nanotubes (NTC) and the nanomaterials for optics and optoelectronics.

French partners:

- The Laboratory of Optic and Photon Materials and Systems (LMPOS), UMR 7132, Paul Verlaine University (Metz) and SUPELEC (coordinator is P. Bourson)
- Jean Lamour Research Association, represented by the Laboratory of chemistry of inorganic materials, Henri Poincaré University (Nancy), UMR 7555, UHP Nancy 1

Russian partners:

- RAC Crystallography Institute, crystallography and crystal growth
- Ioffe Physics – Technology Institute: dialectical properties of optical materials
- Moscow Institute of Electronics: microstructure of lithium niobate, particular, PPLN, optical characteristics
- Ural State University, Institute of Physics and Applied Mathematics: microstructure of lithium niobate, particular, PPLN, optical characteristics
- Mendeleyev RChTU: developing and characterizing of nanotubes, organic synthesis, molecular machines (motors), bioorganic applications
- SPO "Optolink", Zelenograd: development of integral optical systems
- Photochemisry Centre (Synthesis of chromophore and ionophore, inorganic microelectronics (conception and studying the components)), fundamental and applied photochemistry, laser photo physics, materials and nanomaterials
- Institute of Chemistry Physics Problems (Chernogolovka): crystallography, photo chromatics, polymers, conductors
- Rostov State University: photo chromatics, photochemistry, quantum calculations

Scope

Studying of carbonic nanotubes (NTC)

Researches of the project are carried out in cooperation between the Laboratory of Chemistry of Inorganic Materials LCSM and Mendeleyev RChTU and concern the development of new composition carbonic nanotubes, polymers and characteristics of them, particular, mechanical properties. The goal of carbonic nanotubes studying is to develop selective and ultrasensetive detectors for defining the nature of gases. Defining the nature of gases is based on adsorptive and diffusive properties of molecules on the surface of the nanotubes. A possibility of realizing this project is defined by the partners' competence in experimental and theoretical researches concerning growth and characteristics of carbonic nanotubes.

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Nanomaterials for optics and optoelectronics

The goal of the project is to develop, describe and optimize materials to apply them in instruments, using their optical non – linear or electrooptical properties. Materials that are supposed to be used are based on lithium niobates (LN) or organic molecules. One of the directions of this project is to study modern organic systems with conduction or semiconduction properties, organic systems with optical linear or non - linear properties, heterocyclic photo isometric molecules that can be optical breakers.

Joining of these molecules leads to receiving the materials of nanometric growth applied to electronics or optoelectronics. The competence of the French laboratories (LMOPS and AGCOM2 (a group is busy with organic chemistry and molecular materials) from Marseilles, RACA district) and Russian partners covers a spectrum of fields of conception development to receive and characterize these organic systems and also use them in the instruments and equipment in future.

The lithium niobate is one of materials the most used in the devices and systems in integrated optics, this because of a whole of optical properties and rather single physics. Our main studies aim at meeting the needs for characterization and control of functional optical structures used in lithium niobate: micro and nano structuring, components integrated containing such guides, like periodically polarized structures (PPLN) in a partner project between LMOPS and Yekaterinburg University. But also to understand and if possible modelize in a quantitative way the physical phenomena and to develop original methods of characterization, or in the operation of certain integrated devices: derives from the point of operation in the modulators Mach-Zehnder, photorefractive effect and other phenomena photo-armatures in the guides under strong density of power (photoconduction, photovoltaic effect, photo-induced absorption).

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