Nanotechnology subtopics

1.1 Advanced nano-sensors for Environment and Health

Recent progress and advancements in the synthesis of nano-scale materials and coatings have paved the way for the development of innovative and high-performance sensor architectures. The desired properties of such nano-sensor devices include ease of fabrication and integration, compactness, high sensitivity, short response time, reliability and re-usability. In order to achieve the maximum sensor performance, sensing mechanisms (optical, chemical, electrical, mechanical, magnetic, etc.) should be understood clearly. Besides nano-scale materials synthesis, sensor design, sensor fabrication process and recipe development, sensor performance testing is as critical as well for optimum device performance. Environment and health are two major fields in which sensor technologies are heavily used.

The aim of this topic is to pursue research and development (R&D) activities between European and Russian research institutions to promote a strong cooperative interaction, based on KET - Key enabling technologies (nanotechnologies, ICT, advanced materials, etc.) and on the use of top-down and/or bottom-up micro/nano-fabrication processes for advanced and innovative nano-scale sensor structures primarily for environmental and health applications. Sensing mechanisms to be explored might include but are not limited to optical, electrical, chemical, mechanical, and magnetic detection.

1.2 Novel functional nanomaterials based on design and modelling

Functional nanomaterials play a key role in modern technologies improving their cost effectiveness and efficiency as well as expanding industrial applicability. However, the development of novel functional nanomaterials must progress from a laboratory-driven ad hoc discovery process to a more systematic engineering approach based on the use of advanced fabrication and characterization tools along with modelling and simulation. The aim of this topic is to pursue research and development (R&D) activities between European and Russian research institutions to promote a strong operative interaction, based on KET - Key enabling technologies (incl., nanotechnologies, ICT, advanced materials, biotechnology, advanced manufacturing and processing) and on the use of micro- and nanofabrication infrastructures, large-scale research facilities (e.g., synchrotrons, nuclear reactors, neutron sources, free electron lasers) and high performance computing.

Simulation and modelling became an efficient tool for designing robust and high-performance functionalized nanomaterials. Diverse methods, including quantum-chemical calculations, QSAR/QSPR (Quantitative-Structure-Activity/Property-Relationships) or QNAR as a QSAR option for nanomaterials, data mining, the use of artificial neural networks and genetic approaches, accompanied by high-throughput experimental library tests should be used for elaboration of predictive algorithms aimed at development of the new generations of functionalized nanomaterials. The development of nanomaterials by design should be also complemented by rigid nanotoxicity and nanoeccotoxicity metrology tests aimed at directing the progress in production of nanomaterials toward human-friendly and environment-friendly products.