



General overview of the Nanotechnology sphere in the Russian Federation

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Development strategy for Nanotechnology

Nanoindustry – results are determined by new ideas and equipment.

Nanotechnology will change quality of life, solve challenges of energy consumption, environment, food security, poverty, diseases and terrorism.

Nanotechnology will reduce unskilled labor, education will become accessible and continuous.

Participation of Russia in formation of the **nanomarket** will determine its place in the world.





Resolution of the Government of Russia of April 23, 2010 № 282

On the National Nanotechnology Network (NNN)

NNN – is a set of organizations coordinating activities in:

- Manufacture and standardization of products
- development and commercialization of new technologies
- security
- training and retraining
- project financing

Main aim - creation conditions to increase the volume of nanotechnological products





NNN includes:

- RSC "KI" - National Center for Nanotechnology, Nanosystems, Nanomaterials - scientific coordination of President initiatives implementation
- RUSNANO – Innovation Center of Skolkovo
- Organizations, including venture capital funds, funding development of Nanotechnology;
- scientific, design, production facilities and laboratories in the Academy of Sciences – R&D in Nanotechnology, Nanoproducts manufacture





NNN formation is carried out in two stages:

- First phase – 2007...2010 (*completed*)
- Second phase – 2011...2015

First phase - creation of a competitive sector of R&D in **Nanotechnology** and an efficient system for the commercialization.

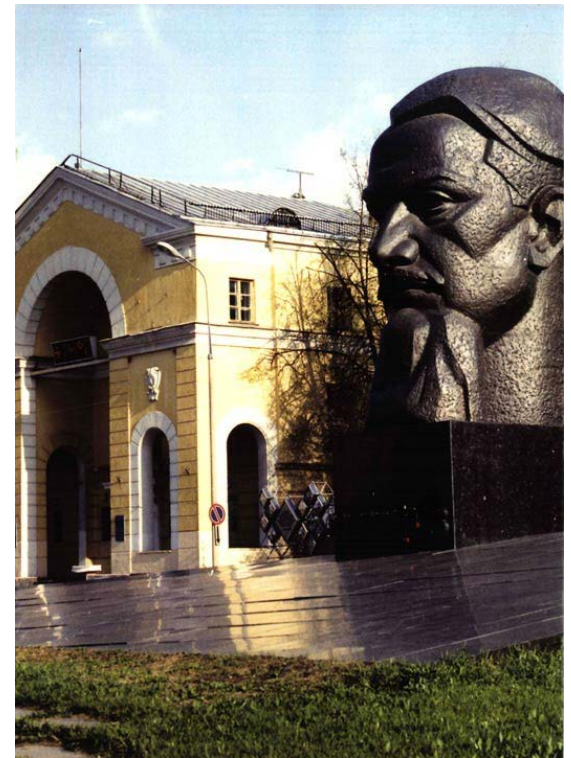
Second stage - creation of conditions for large-scale Nanotechnology production capacity growth and bringing Russian organizations to the world market of high technologies.



Head agency of NNN - Russian Research Centre "Kurchatov Institute".

Objectives:

- coordinated development of nanotechnology
- comprehensive examination of research, analysis of results and their potential for production and sales
- organization of cooperation for research, commercialization, mass production
- effective use of unique equipment





RUSNANO – Russian Corporation for Nanotechnologies

The government has invested 130 billion rubles in the authorized capital of RUSNANO, but the corporation is not entitled to support research and development.

Activities:

- In all aspects of **Nanotechnology**, the Company acts in the RF interests, assuming the role of key coordinator of innovation policies.
- Commercialization of Nanotechnology- the aim is to achieve and demonstrate positive commercial results making **Nanoindustry** attractive to sources of private investment.
- Efficiency. The aim is to maximize its efficiency in accomplishment of its goals and avoiding any unnecessary expenditure.





RUSNANO intensified investment in pharmaceuticals

The revival of pharmaceuticals is a matter of prestige and health of the nation.

Currently 80% of the Russian pharmaceutical market - imported medicines, the share of innovative products on the Russian domestic market is about 1%. At the global pharmaceutical market it is not more than 0.04% of Russian products.

But five significant innovations are at the stage of preclinical and clinical studies: treatment of AIDS, hepatitis C, central nervous system, pancreatic cancer.





Objectives of the three main stages of Nanotechnology development in Russia

1. Radical increase in the output of marketable high-tech products
2. Bringing new nanotechnology products to commercial levels
3. Rapid development of new areas of nanotechnology, creation of a cross-branch scientific, educational and work environment

The main content of the stage - creation of:

- *nanobiotechnology products*
- *hybrid bionic devices and instruments*
- *nanobiosystems and devices, including hybrid bionic systems for biorobototechnical systems sensitizing*



What is Skolkovo?



The strategic goal of the Skolkovo Innovation Centre is to concentrate international intellectual capital, thereby stimulating the development of breakthrough projects and technologies.

In the course of implementation of the project, companies that are engaged in innovative development are discovered. After a selection process some of these become project participants of the centre. They are provided with all assistance necessary for development.

The Skolkovo Foundation and its partners transform the infrastructure, resources and other possibilities of the centre into effective services for companies that are project participants.

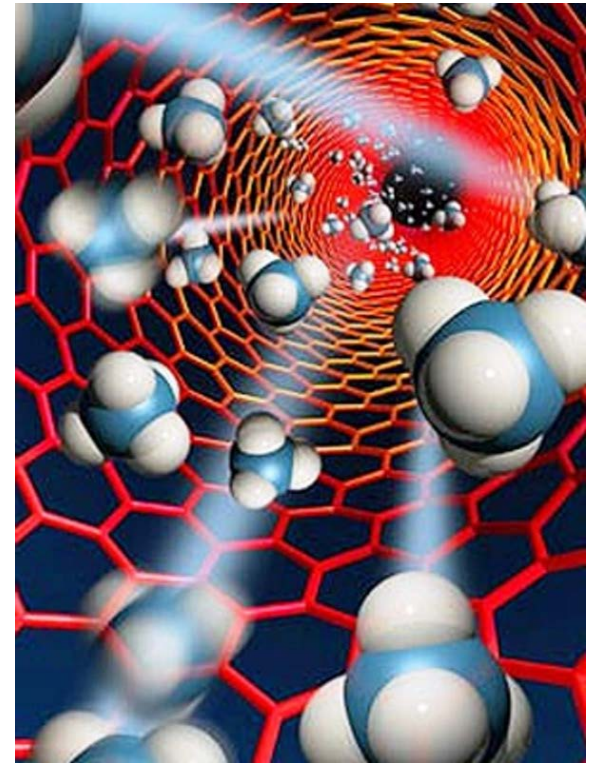


Main policy tool in Nanotechnology

**Nanotechnology development
in Russia up to 2015.**

NNN is to ensure:

- concentration of resources on priority areas
- more efficient development
- creating conditions for placing
Nanotechnology products on the market





Educational programs on nanotechnology

RRC "KI" with leading universities of the country (Lomonosov Moscow State University, Moscow Engineering-Physical Institute, Bauman MSTU, MEI, MISA).

RRC "KI", JINR, Institute of Crystallography. Shubnikov of RAS, CIS Interstate Fund for Humanitarian Cooperation - courses in nanosystems study for young researchers, graduate and undergraduate students .



Areas of research in universities:

- Nanoelectronics – **MIET**
- Nanoengineering – **Bauman MSTU**
- Functional nanomaterials and high-purity substances – **Mendeleev RCTU**
- Functional nanomaterials for power engineering – **MRPHI**
- Functional nanomaterials for aerospace applications – **MAI**
- Nanobiotechnology – **Institute "IT", MSU, BeISU**
- Structural nanomaterials – **NITU "MISIS"**
- Composite nanomaterials – **SPbGU**
- Nanotechnology for security – **SPbETU**
- Ensuring traceability, standardization and conformity assessment – **MIPT**



Results of the first phase of Nanotechnology development

*The priority must be given to areas where Russia
has been working on the worldlevel.
Acad. Alfimov*

Federal Program "Research and development in priority areas of scientific-technological complex of Russia for 2007-2012".
"Industry of Nanosystems and materials" has a key role.
Federal Program "Scientific and scientific-pedagogical personnel of innovative Russia" for 2009-2013 and
"Nanotechnology infrastructure development in Russia for 2008-2010" (extended to 2011, decree of 21.06.2010 № 471) are also related to nano.





RAS activity in nanotechnology

The approach in Russia is based on the idea that fundamental issues have been solved.

But Americans are investing in research more than half of the budget for development of Nanotechnology.

Russia needs a change in project activities, which would not only ensure implementation of many projects, but also supplement the budget of science: the main obstacle is lack of the infrastructure.





RAS activity in nanotechnology

More than 150 million rubles has been allocated for R&D in Nanotechnologies.

RAS follows the trends in science. It is ready to change the emphasis in the themes, but because of the fall of the interest of the society to promising studies it declined not going to.

While keeping the "nanoscience" on the priorities list, the RAS repeats: the public policy in the field of nanotechnology has not got built in the best possible way.



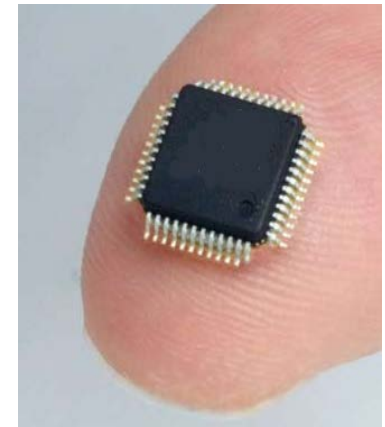


Main achievements:

1) **Creation of new high-tech jobs and increase of capital intensity of production.**

Technical re-equipment of NNN umbrella organizations, creation of 20 research and education centers (REC).

The company NT-MDT - success in the market for nanotechnology equipment, supplied to more than 45 countries. Sales volumes for two years, almost 2.0 billion rubles.



2) **Improving the quality of healthcare.**

Biochips to diagnose of tuberculosis, smallpox, mutations in the human genome. Diagnostics time – up to one day, benefit per onepatient more than 120 thousand rubl. Biochips based laboratories have been installed in 20 TB clinics in Russia



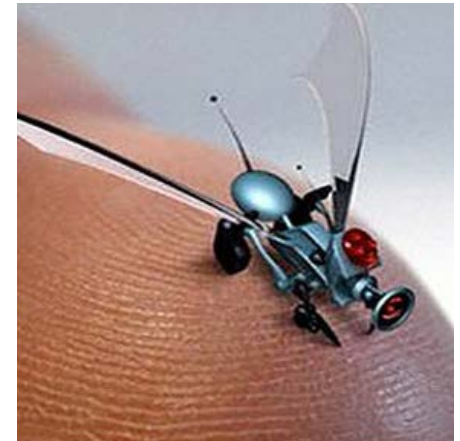
Main achievements

3) Improving the environment.

Membrane catalytic systems for saturated hydrocarbons treatment. Mass production of catalysts for associated petroleum gas processing. Technology of Nanostructured membrane-filters for gas and liquids (water) purification.

4) Reduction of material and energy intensity of industrial product.

Full-scale production of semiconductor light sources - from heterostructures to fixtures. Comprehensive implementation of LED technology in the Russian Railways. Composite materials with unique energy saving features. Concrete with nanodispersed and polymer components to improve sustainability of road surfaces.





Developments in the "Industry of nanosystems and materials":

Created:

Nanostructured construction materials for shipbuilding, fuel and energy complex.

Developments are protected by patents and a number of know-how. The fundamental concepts of breakthrough processes have been formed. Setting of the project at the intersection of nanotechnology and environmental management is necessary. A market for nanostructured materials and welded structures for engineering worth 9 billion rubl. per year is being created.

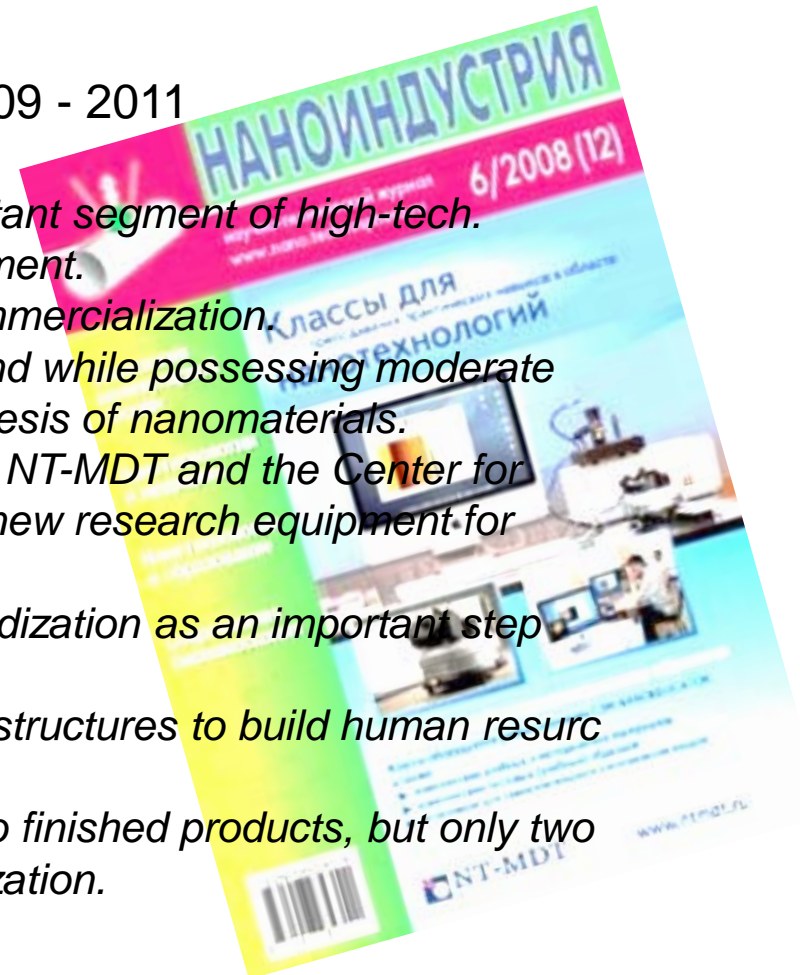


Analysis of materials of the journal "Nanoindustry"

Published since 2007. Publications for 2009 - 2011

Conclusions:

1. *The journal reflects the situation in an important segment of high-tech.*
2. *Papers are devoted to manufacturing equipment.*
3. *R&D results are interesting, but far from commercialization.*
4. *Foreign equipment is mass manufactured and while possessing moderate parameters can be used in research and synthesis of nanomaterials.*
5. *A large proportion of articles, in particular, of NT-MDT and the Center for Advanced Technologies, is devoted to Russia new research equipment for scanning probe microscopy.*
6. *A part of publications are devoted to standardization as an important step towards the stage of commercialization.*
7. *A number of articles devoted to educational structures to build human resurc for Nanotechnology.*
8. *About 25% of the publications are devoted to finished products, but only two or three states are at the stage of commercialization.*





Some priorities

The country's position in the innovation process depends on the choice of priorities.

Purpose - to identify strategic directions for the growth of welfare

An important element - the Foresight study to evaluate promising areas for Russian science and technology. The survey was conducted in 40 Russian regions

Generalized evaluation included

- the most important results that can be achieved within 20 years;
- the contribution of technology in solving social issues and ensuring national security;
- promising market niches, in which Russia could win good positions;
- the potential effects and risks of development of new technologies.



Assessment of developments on the subject

"Industry of Nanosystems and Materials"

The index of importance the area is 82.6. 5% correspond the world level, 81% - some lag, 14% - have a significant lag.

The most important the membrane and catalyst systems, are 87.0 (maximum 100). Technology of biocompatible materials, polymers, and crystalline materials lag behind by 1.2 - 1.3 points.

The most promising are biocompatible materials: simulating living organisms, and nanostructured coatings for implants working under load; nano-container delivery of medicines, materials for emergency control of bleeding, magnetic nano-carriers with adjustable Curie temperature (42-45°C) for treatment of tumors, drugs deliver and magnetic tomography.

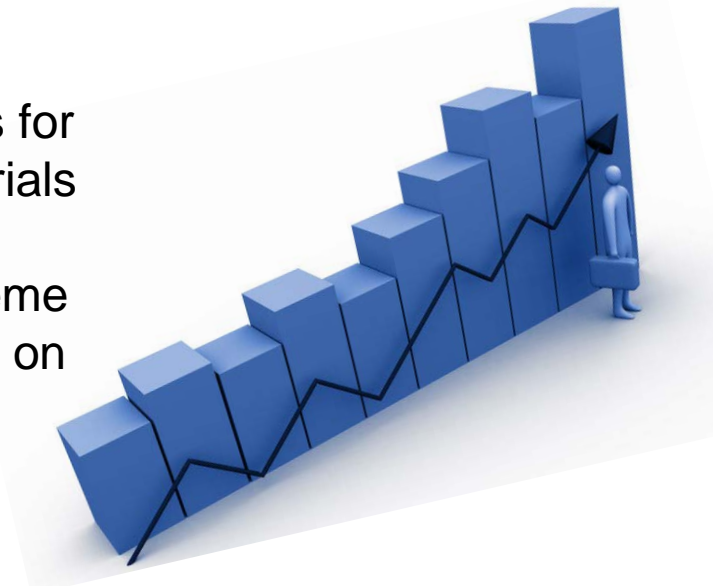
Significant effect is expected for energy (alternative energy sources: solar panels, portable fuel cells, batteries, hydrogen, electrochemical and thermoelectric power sources, supercapacitors).



Developments and level

The highest level of development belongs to membrane and catalyst systems, composite and ceramic materials. Those with the least noticeable lag: micromechanical accelerometers, optical spectrometers, filters for moving diffraction gratings (console rack-type structures) obtained by deep anisotropic plasma etching of silicon.

The most developed areas are reinforcing coatings for tools; crystalline and nanostructured metallic materials with improved functional properties for transport; corrosion-resistant materials and coatings for extreme operating conditions, filters and membranes based on nanomaterials for air and water cleaning and its desalination.





Developments level and time



30% - emergence of scientific and technological solutions by 2015. 1% the time to enter the market – 2015.

The largest share of developments ready for implementation up to 2015 for the catalytic systems (57%). For biocompatible materials - 2016-2020.

Major developments (83%) will be brought up to commercial use in 2016-2020.

The earliest dates are for polymers and crystalline materials. (4% of the developments will be mastered by 2015, 92% - 2020).



Large investment projects:

"Industry of Nanosystems and materials"

Medicine

- biomedical materials and nanodrug delivery;
- nanostructured materials and coatings for implants;
- biocompatible materials initiating the living tissue;
- nanomaterials for emergency bleeding control.

Materials

- Polymers with improved mechanical and chemical resistance, anti-friction, heat and fire, corrosion-resistant coatings for extreme conditions;
- strengthening coatings, functional and multifunctional thin diamond films.





Large investment projects:

"Industry nanosystems and materials"

Power engineering

- Traditional and alternative energy sources (solar panels, portable fuel cells, electrochemical, and thermoelectric power sources, super-capacitors, compact hydrogen generators);
- conversion of by-gas close to production sites.

Military equipment

- Nanostructured materials to enhance the efficiency factor of solid rocket fuel (RT) 15 times;
- Increase in flight range of strategic missiles by 400-800 km;
- Creation of a high-momentum PT, increasing the efficiency of explosives 1.5-2.5 times.





THANK YOU!

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