Business plan

New application of nanomaterials for aerospace

Alexander Frolov

Russia 2025

The objectives

- The objective of this project is to create a new structural material for the aerospace industry. The current target in 2025 is to find suitable nanotechnology partners in China who are willing to host their laboratory to study the proposed technology for practical applications.
- The purpose of the experiment in the laboratory of the Chinese partner is to obtain the proof of the principle and create prototypes of new materials.
- The main goal of the project is to create a joint venture in China that will produce and sell new technology power units for aircraft, drones and space propulsion systems.

History of the project

- This project uses a new physical effect, which gives new prospects for the development of aviation and astronautics.
- The main technical ideas have been known since 1935.
- In the period 1996-2025 authors invested about 5,000 USD of own funds in the project.
- Mr. Frolov demonstrated this effect (without nanotechnologies) at the conference "New Ideas in Natural Science" in St. Petersburg in 1996.
- In 2003, co-author Mr. Mikhail Beshok from St. Petersburg published the idea of using micro-relief to achieve the desired effect.
- In 2011, Mr. Frolov published the basic principles of this technology in the book New Space Technologies.
- In the period 2011-2025, Mr. Frolov started experiments on this project.

Current status

- Mr. Frolov conducted an experimental approbation of two technologies (nanotubes on TiO2 in 2011 and silicate aerogels in 2016). The results are minor.
- In 2021, a computer simulation algorithm was developed that will be used to create a new nanomaterial.
- In 2023, experimental studies of other Russian-made nanomaterials are organized by Mr. Frolov.
- In 2025 some results were measured with carbon nanotubes.
- Currently, the authors of the project are looking for a nanotechnology partner in China, which has its own laboratory and the ability to organize experiments to create prototypes of a new nanomaterial.

About the Chinese partner

- China has been chosen as the main partner of this project, as more than 50 universities, 20 institutes of the Chinese Academy of Sciences (CAS), and about 300 companies are developing nanotechnologies.
- Chinese scientists have published more than 30% of scientific articles on nanotechnology worldwide. Between 2000 and 2023, Chinese scientists filed more than 200,000 nanotechnology patent applications.
- The development of the project in Russia was started in 2003, but without significant experimental success, since the authors of the project are not related to the Russian Academy of Sciences. The authors have made good progress in developing the theory in this project, but the possibilities of the authors in organizing experiments with nanomaterials in Russia are extremely limited.

Overall strategy

- The project begins with a search for a nanotechnology partner in China. An NDA and an agreement on equity participation in the creation of a future company are required. After signing the documents, the Chinese laboratory organizes experiments to get proof of the principle. The authors organize free remote consultations without visiting China.
- Upon receiving positive results of the experiment, the Chinese side must invite the investors and invites the authors to China to register a new Chinese research and production company. Authors receive funding. All costs should be covered by the Chinese side.
- Further, the company will work to build the prototypes of new products, demonstrate the prototypes for customers, start production and sales.

Search of Chinese partner

- Search by territory: We now need to determine the region of China in which the largest number of nanotechnological laboratories are located. We need scientific laboratories, not the production companies
- Other areas of China also can be interesting for information analysis. Perhaps there are also nanotechnology laboratories with nanomaterials for the project.
- Search by subject. Search through all Chinese companies that have published their results on the subject of "nanomaterials on a substrate", for example, nanotubes on metal foil. Exclude materials in the form of powdered nanoparticles from the search.
- It is not necessary to search companies with offer to create nanomaterials “on demand”.

Product and applications

- The new nanotechnological product as named Active Force Nanomaterial. It is a solid state material plate with a special nano-relief on one side. This product creates an active (non-reactive) driving force due to the difference in air (gas) pressures on both sides of the plate.
- The product is planned to improve the technical characteristics of drones, aircraft, including space technology.
- The product can be manufactured as small propulsion force blocks. The blocks are hermetically sealed enclosures containing gas, a heat source, and the nanomaterial.
- The complex of several propulsion force blocks forms the propulsion unit of the aircraft or drone or spacecraft.
- Also we can offer hybrid propulsion units, i.e. standard reactive jet propulsion can be modified with new nanotech.

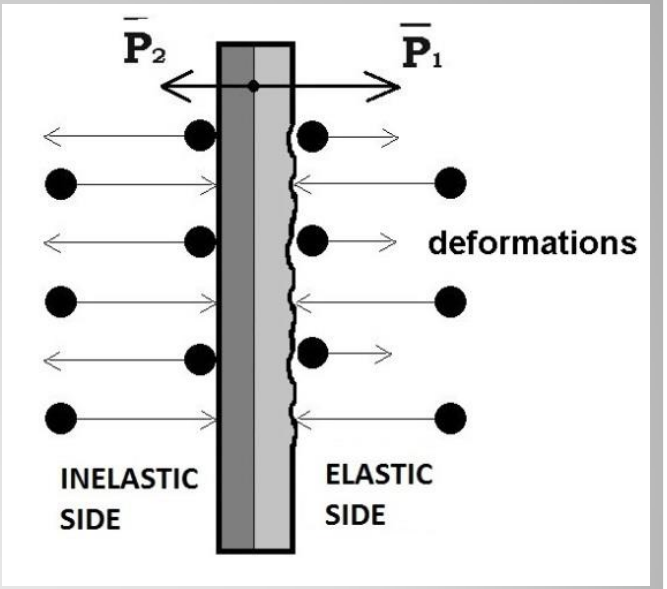
Idea

- Special nanostructures can take off part of the kinetic energy of gas molecules, due to their size and physical properties.
- During this transformation of the kinetic energy of the gas, nanomaterials and gas are not consumed.
- The energy conversion of gases by means of special nanomaterials can be used to create a unidirectional force impulse, for example, to create the lifting force of an aircraft.
- There are several variants of nanomaterials to get this effect.

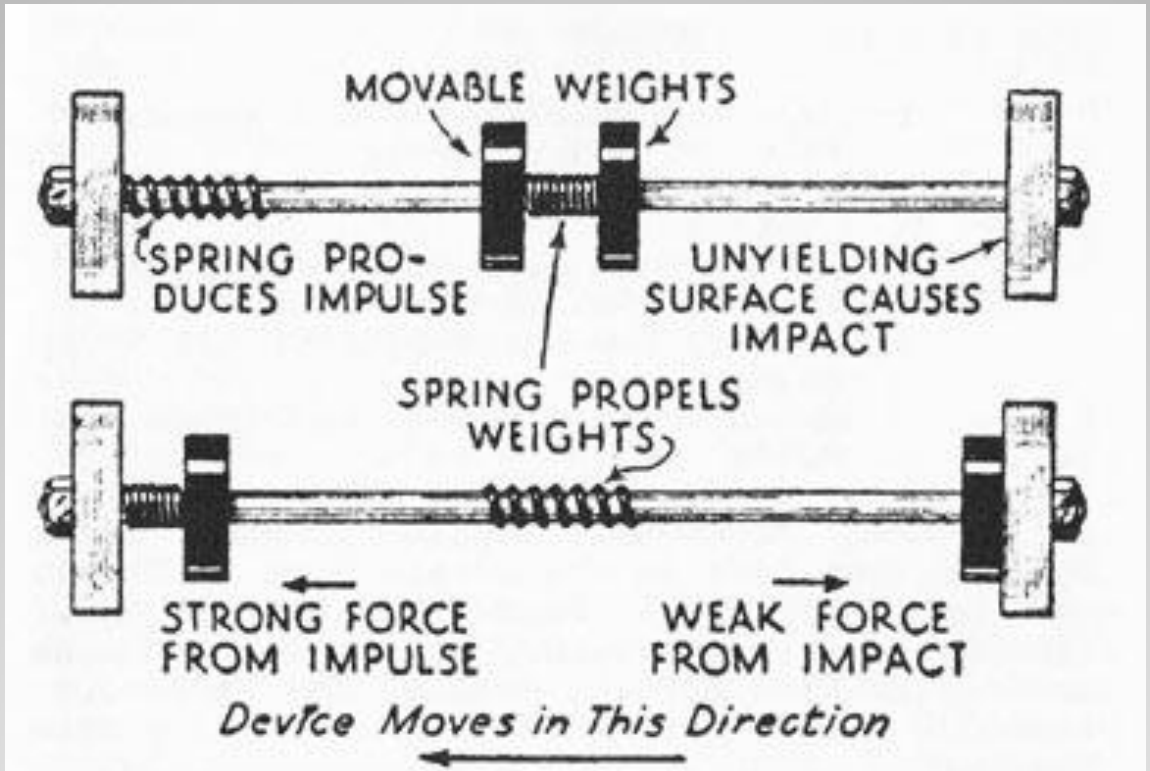
Variant: elastic interaction

Due to the difference in elastic properties on both sides of the plate, a gas pressure gradient across the plate can be obtained. To do this, you need to create elastic nanostructures on one side of the plate.

Nanostructures can be various. It can be nanofibers, nanowires, nanoforest and other nanostructures.

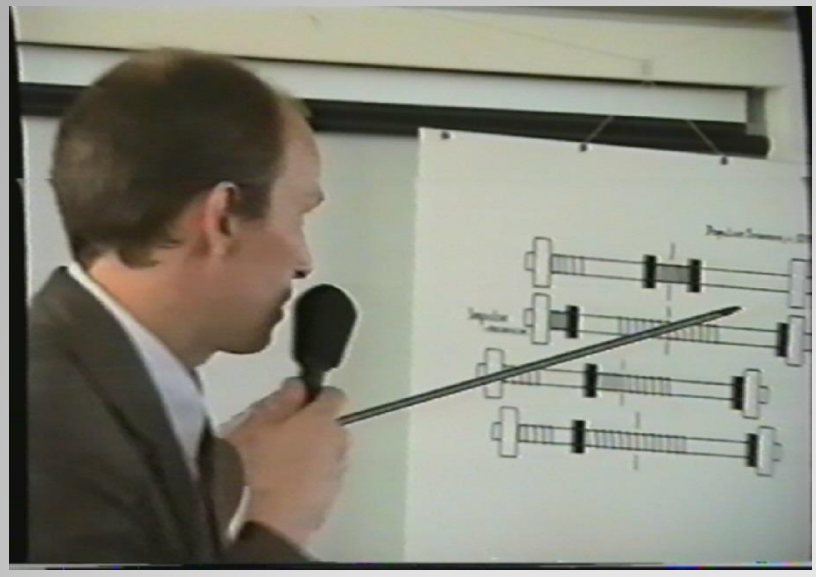


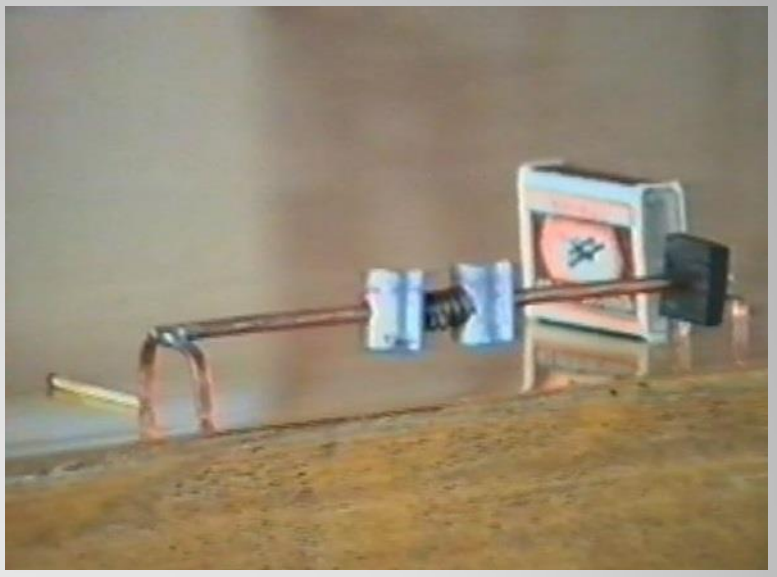
Experiment on elastic interaction 1935



Harry W. Bull Popular Science, Vol. 126 1935

Frolov's experiment of 1996



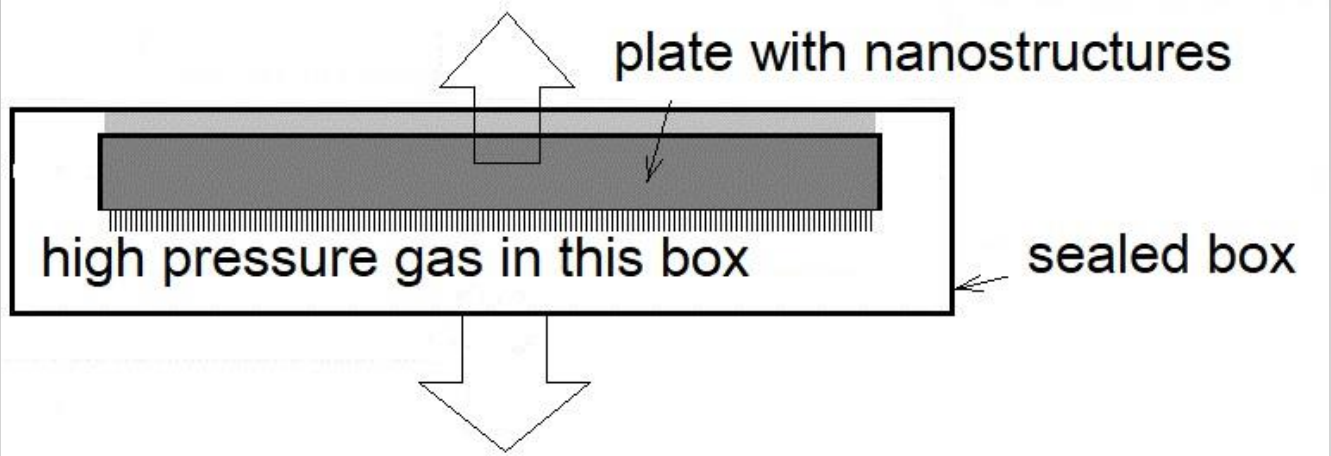


Alexander Frolov demonstrated an analogue of the experiment in 1996 at the conference "New Ideas in Natural Science", St. Petersburg. It is not nanotech but it is the same principle.

How to get inner pressure gradient

Special nanostructures make it possible to get gradient of inner gas pressure.

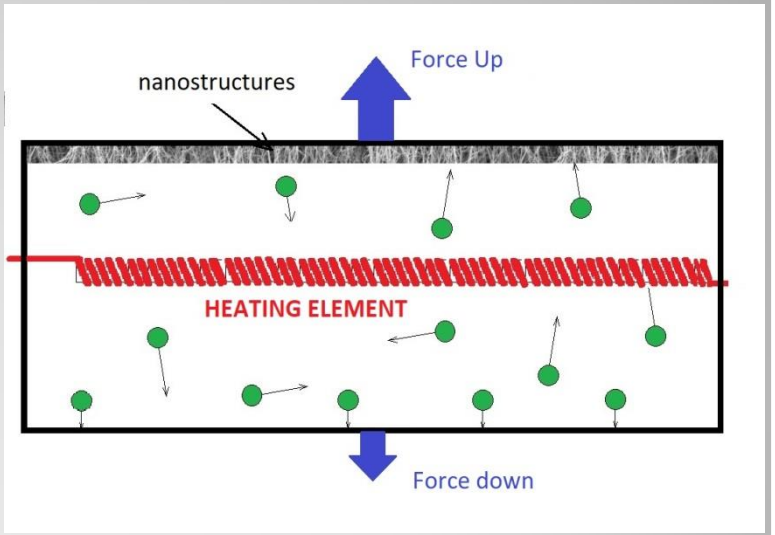
Also it is possible to apply mesoporous materials.



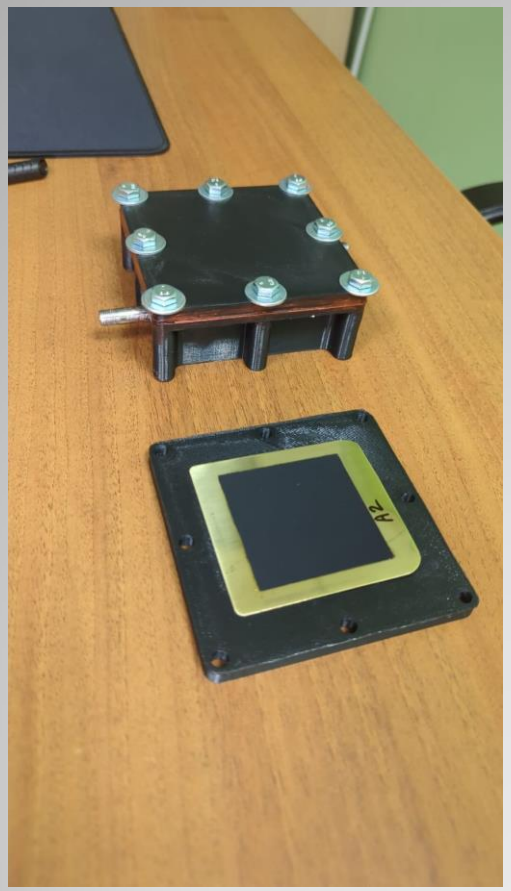
Application of nanostructures as elastic elements

Elastic nanostructures make it possible to partially take off part of the kinetic energy of gas molecules. By this way we can get more powerful gas pressure gradient inside a closed box.

Heavy gas (for example, argon or xenon) and increased gas pressure can be used. The heating element provide the high pressure.



2025 experiments

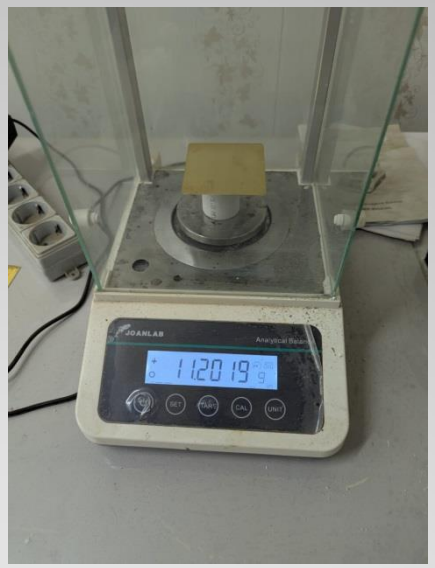


The box and the cover. Plate with nanomaterial is installed on the inner side of the cover.

High pressure gas is argon.

In this version the heating element is not included in this desing.

2025 test

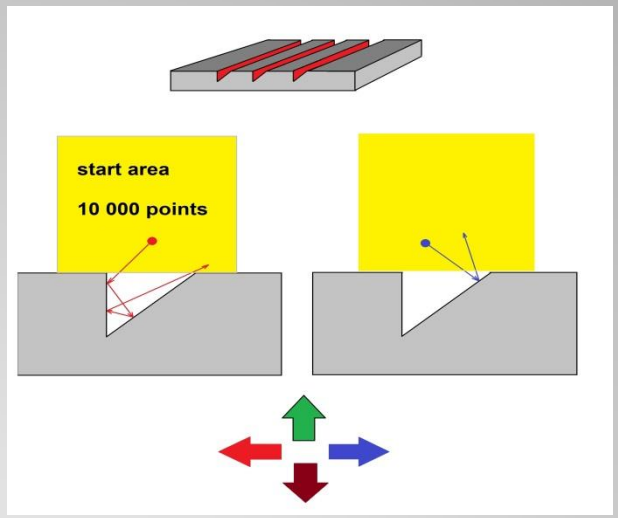


This experiment is test of nanomaterial plate. The weight is different in the case “nanosurface up” and “nanosurface down”. After this test this nanomaterial must be tested in closed sealed box under high pressure gas. We use agnon. Argon is more heavy gas than air.

Other directions of research

You can get the estimated effect by creating a special "asymmetric relief‟ on a surface. The uncompensated force of gas pressure on the surface can be calculated by computer simulation.

Also the gas pressure gradient can be obtained by creating a "Bernoulli effect" near the surface (micro-wind and micro-tornado) due to special nanostructures.



For this direction of the research, we need a partner who can produces microelectronics with chip element sizes of about 50 - 100 nm.

Technical advantages

- Fuel. Application of this technology in aviation and astronautics significantly reduces fuel consumption and operating costs.
- Reliability. An aircraft propulsion unit may be composed of a plurality of individual propulsion force blocks. Damage to several small propulsion force bloks is not critical for the operation of the propulsion unit. The propulsion blocks can be placed throughout the volume of the aircraft, since aerodynamic characteristics are not important for this type of propulsion.
- In astronautics, the new technology greatly increases the range of flights, since fuel is not required. On board the aircraft, only a source of thermal energy is required. Small spacecraft can get energy from solar panels. Large spacecraft can use nuclear power plant as source of heat.

Production and supplly chain

- Products can be developed on demand for aerospace customers, or it can be produced in large batches as unified standard propulsion units.
- For the production of these products, it is necessary to create a chain of suppliers of general-purpose materials (metal housings, gas, valves, etc.).
- The nanomaterial must be produced in-house by own production facilities to prevent leakage of know-how.

Stages of the project

Stage	Months
Experiments	6
Patenting	6
Production of demonstration prototypes	12
Start of sales	24 months after start

China market and segments

- The Chinese drone and aviation market is main buyers. Licenses can be sold to the China state bodies.
- The volume of the Chinese aviation market is about 1 trillion euros. The market is growing at about 6% per year. By 2035, China will need 5,110 new aircraft worth $535 billion. The aim of the project is to reach the level of sales of 100 million euros per year after 5 years of the project.
- The second promising market is drones, the market size is about 75 billion dollars.
- The most interesting market for the proposed product is space technology (satellites and deep spacecraft). There are more than 140 space companies in China. More than 300 billion USD are invested in these companies every year.

Unique selling points

The application of the proposed technology in aviation and astronautics gives unique qualities for the aircraft manufacturers :

- Reduced fuel or electricity costs. Accordingly, the flight range increases, and the cost of cargo delivery is significantly reduced.
- Due to the arrangement of a large number of propulsion units in a single aircraft propulsion device, the reliability of equipment is significantly increased and flight safety is increased.
- The proposed technology uses a unique new physical effect of creating a thrust impulse in a closed housing. It is environment friendly technology.

Competitors

- Competitors of this project are some innovative companies that are working to reduce fuel consumption by aircraft propulsion.
- In the drone market segment, competitors are trying to increase the flight time and range on a single charge of drone electric batteries. They are developing new batteries and new sources of onboard electricity.
- Competitors in the space industry are companies that develop ion thrusters for microsatellites.
- There are no known competitors who are developing similar nanotechnology to create new aircraft propulsion.

Competitive advantages

- The product we offer gives a new quality to all aircraft, both in aviation and in space: no fuel is required on board the vehicle.
- The project has a long history of development, its prospects and technical aspects are worked out in detail by the authors.
- The cost of aviation and space propulsion, using the proposed technology, is much less than the cost of any modern propulsion technology.
- Mass production facilities in China can provide great competitive advantages for this project.

Barriers to entry the market

- Barriers to entry into the aerospace market are insignificant, since after successful demonstration of aircraft prototypes with new propulsion technology, we'll see high demand for the proposed product.
- A serious barrier can be created by the efforts of competitors who use outdated propulsion technologies. Competitors can use administrative resources and various bureaucratic methods, which can significantly delay the process of obtaining permits and approvals of documents that will be necessary to start selling new products.

The business model

The proposed product is suitable for two business models:

- B2B is the organization of sales of products (propulsion force blocks and propulsion units of a new type) for customers, including drone manufacturers, aircraft manufacturers and space technology manufacturers.
- B2G - sales of licenses to government organizations to create special-purpose products.

Marketing strategy

- Marketing begins after obtaining patent protection.
- It is necessary to create several types of demonstration prototypes of drones or aircraft using propulsion blocks of the new technology.
- The first target customer may be the largest manufacturer of Chinese drones.
- Product sales options:
  - Unified propulsion units. It can be mass-produced units and we can sale it with retail network of aerospace parts suppliers.
  - On demand sales of the propulsion units. It can be specific product which is manufactured according to special technical requirements of some customers.

Financial plan

Stage	Months	Cost
Experimenting	6	30,000 USD
Patenting	6	30,000 USD
Prototyping	12	45,000 USD
Sales start	After 24 months	-

A detailed financial plan will be drawn up after the experimenting phase of the project. Now it is difficult to calculate the costs and profits of a future company in China.

Risk

- We do not transfer the finished product from Russia to China. The first phase of the project begins with experiments in one of the existing Chinese laboratories. The financial risks of the first stage are minimal, since a new laboratory is not required, and the authors participate at this stage free of charge.
- The technological risk is that some of the nanomaterials that can be successfully applied in our project may have a very high manufacturing cost. We need to look for non-expensive nanomaterials that is suitable for mass production.
- Macroeconomic risks are minimal, as the current situation in the world is favorable for the development of new technologies in aviation and astronautics.
- Political risks of the cooperation of Chinese and Russian partners are minimal.

China business structure

1. It is advisable to start the project on the technological base of the existing laboratory in China, with remote consultations of Russian authors.
2. After receiving reliable experimental data, it makes sense to choose a new location in China to register a joint R&D company.
3. The structure of the new company includes the following divisions:
   - laboratory, office, accounting
   - marketing department (after 6 months)
   - pilot production (after 12 months)
   - conveyor production (after 24 months)

Shareholder structure

The following structure of participants in this project is proposed:

- Founder of the company 30%,
- Chinese investors 51%,
- Nanotechnology partner 9%
- Top management 5%
- Co-authors 5%.

There is possibility to find nanotechnology partner company as the Chinese investor. In this case this shareholder will own 60%

Request to Chinese partner

We expect the following technical capabilities from the Chinese partner:

1. Experience in the fabrication of nanomaterials on a substrate.
2. The substrate may be of any type, such as metal foil or other inexpensive material.
3. The type of nanomaterial should have maximum sensitivity to interaction with gas molecules. Sensitivity means the ability of nanostructures to deform when interacting with gas molecules.
4. Known types of nanomaterial that may be applicable for this project: nanohairs, nanowhiskers, nanowires, nanofibers and so on.
5. The verticality of the nanostructures on the substrate is not required.

The team

- Mr. Alexander Frolov, Founder of the project, live in Tula, Russia. Future CEO of the company being created. High technical education. More than 10 years of experience in managing research firm Faraday LLC. Expert of the Russian Physical Society. Author of the books New Energy and New Space Technologies. More than 80 publications in scientific journals.
- Mr. Beshok Mikhail, co-author. Constructor. St.-Petersburg.
- Top managers from China, representatives of interested Chinese companies, leading specialists of Chinese nanotechnology companies.

Contacts

Alexander Frolov

+7 980 7243309
+7 920 794 4448

www.faraday.ru

a2509@yahoo.com

alexfrolov2509@gmail.com