

**Summary**

1. **Volume of investments required – \$ 150 thousand.**
2. **Production** – technologies of comminution, mechanical alloying and mechanical activation; nanomaterials.
3. **Trade marks** – none.

Company profile

Date of establishment – July 2006.

Signs of public recognition – the project of TTD company and the St. Petersburg State University (SPbSU) mechanical chemistry research group on fine and nano-powders was one of the winners of the Contest of Russian Innovations 2003 of the “Expert” journal (see article in Iss. 33 (386), Sept. 8, 2003); it was awarded a grant of the Russian Association of Venture Investments. A joint project of TTD, SPbSU mechanical chemistry group and a number of European partners in the frame of the 6th Framework Programme of the European Community was among 16 projects with Russian participation (nanotechnology priority). The project was devoted to material comminution in high-energy mills in the production of hard alloys, ceramics and composites. 12 organisations from European countries took part in the project, including small and medium enterprises, and Europe’s premier aerospace company EADS (Germany). The grant allotted by the European Commission amounted to 2 million euro, the participating companies contributed 1 million euro.

Number of employees – 9 persons.

Team

Chernik Galina – Director, 50 y.o. PhD (Chemistry); experience in management of international research projects. Initiated the project of the 6th Framework Programme of the European Community.

Fokina Elena – Senior Researcher, 53 y.o. Developer of grinding technologies, author of patents on ceramic materials and on mechanical activation of drugs; large experience in research work in the field of inorganic materials and experience in the development of technologies of powder production.

Budim Nadezda – Senior Researcher, 62 y.o. Developer of grinding technologies; author of patents, experience in the development of technologies of powder production.

Vasilyeva Yevgenia – Senior Researcher, 53 y.o. PhD (Chemistry).

Skoudnov Sergei – Engineer, 50 y.o.

Products characteristics

This project is aimed to development of technologies based on the use of planetary mills. Unlike ball mills, working on mere gravity, planetary mills utilise centrifugal forces generated as a result of drums rotation around the central axis and around their own axes. Applied accelerations are tens times as high as the gravitational acceleration. Therefore, the energy applied to the material processed in these mills is much higher than in conventional milling equipment (ball mills and attritors). At present in Russia planetary mills are produced that feature high accelerations and throughput rate of 18-40 kg/h for powders with a particle size less than 10 µm. The processes of comminution and mechanical alloying can be carried out in planetary mills 10–30 times faster than in attritors. The company maintains close partnerships with the manufacturers of mills and develops technologies of production of nanostructured materials.

Grinding processes are widely used in chemical industry and ceramics production, powder metallurgy, manufacturing of catalysts and drugs.

It is known that nanopowders themselves (those with a particle size under 100 nm) are extremely inconvenient in use, as they are voluminous, raise in the air at opening container, and their influence on human health has not yet been documented well. There exists a number of applications which require powders with nano-sized particles, e.g. for chemical mechanical polishing. However, in many other practical situations it is not the tiny size of the particles that matters but some other properties, for example their behaviour at sintering of solids and coating deposition. In these cases mechanically activated particles of micron and submicron size consisting of crystallites of the size under 100 nm are more useful and convenient. Of practical interest are composite powders with a metallic matrix strengthened with nano-size particles of a solid phase.

The processes of mechanical alloying are used in powder metallurgy for obtaining heat-resistant superalloys. Dispersion-strengthened alloys are necessary for aerospace and automotive industries, turbine production and electrical contact materials fabrication.

We are sure that the application of planetary mills for mechanical alloying is promising. Our company is ready to develop the technologies of production of dispersion-strengthened alloys based on the use of planetary mills, for example of alloys based on nickel, iron, cobalt, copper, aluminium, titanium and other metals. Our company owns a patent for the method of applying metal coating on powders.

Comparison with analogs. As a result of mechanical alloying in planetary mills (TTD) of Al/Al₂O₃ and Al/NiTi composites, a high degree of coverage by metal of the solid phase particles, good adhesion and homogeneous distribution of the solid phase in the metallic matrix at significant reduction of the time of the process was achieved. To bring the crystallite size down to under 100 nm, it took 20–90 min processing in a planetary mill, whereas it took from 8 to 24 h in the reference mills and attritors.

Mechanical activation of poorly soluble drugs with the aim of enhancing their solubility and activity is also promising.

Current state

The company is carrying out research projects on the development of technologies of comminution and mechanical alloying.

Development strategy

Use of funds

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|---|-----|
| 1. R&D | 30% |
| 2. Acquisition of fixed assets (planetary mill) | 30% |
| 3. Marketing | 20% |
| 4. Acquisition of current assets | 10% |
| 5. Other | 10% |

Prospective outcome of investment

Investments requested – \$ 60 ths in the 1st year, \$ 90 ths – in the 2nd year. Same sums are supposed to be received in the frame of "Start 06" programme. As a result of investment, a planetary mill of higher efficiency will be purchased, which will allow us to raise the productivity of comminution processes and of mechanical alloying. To reproduce processes elaborated for laboratory mills on a larger scale will require working out of technological regimes. This will allow making samples in amounts necessary for consumers and demonstrating the potential of the technology in the production of composite powders. Our company offers the conduction of R&D work for the assessment of the possibilities of novel milling equipment. The goal of our company is selling technologies based on the use of planetary mills.

Marketing & Markets

The main consumer groups are the companies engaged in powder metallurgy and pharmaceuticals. The scheme of promotion is distribution of information on the technologies via Internet and through participation in international exhibitions and conferences of powder metallurgy and pharmaceutical industries. Participation in the 7th Framework Programme of the European Community is expected to be useful, as this allows us to establish long-term business partnerships with European companies.

Interaction with investor

Investor's share – 20%; IRR – 41%; exit – in 4 years by selling the company to a strategic investor.