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SSTU popular science edition

TECHNOPOLIS OF THE VOLGA REGION

Top digest 2015

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Top digest 2015

Founder

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Dmitry Bykov, Rector of Samara State Technical University,
Honored Worker of Higher School of Russia, Editorial Director of the
«Technopolis of the Volga Region» journal

Dear Colleagues,

A lot of great events have taken place in the life of Samara State Technical University in the past year. I'm convinced they will belong to the history of Russian science and education. Despite objective difficulties the University has managed to maintain and stabilize its position in the rating of the national top universities. The consolidation of Samara State Technical University and Samara State University of Architecture and Civil Engineering was clearly one of the major events. We have had long-standing relations, so the integration will give us a fresh impetus to achieve the development of the technological master course, to strengthen the scientific capacity and to provide new opportunities for international activities.

And, of course, the key news of the year was the fact that SSTU has won in the competition of Russian universities applying for the title of the supporting university. The Ministry of Education and Science approved the programs providing the establishment of major multifunctional university centers only for the eleven national universities. Samara State Technical University was the first supporting university in our region. That means our university will receive additional grants to create a system for attracting talented students, for developing new laboratories and academic schools, and for cooperation with large enterprises. Priority directions of SSTU in the status of supporting university include oil and gas complex, metalworking and foundry technologies, high technologies in construction and architecture, modeling and management of complex technical systems and technological processes, promising types of weapons, military and special equipment and military-industrial technologies.

Also, scientists of our University have managed to draw the attention of the Russian audience to a number of unique developments and scientific discoveries in the past year.

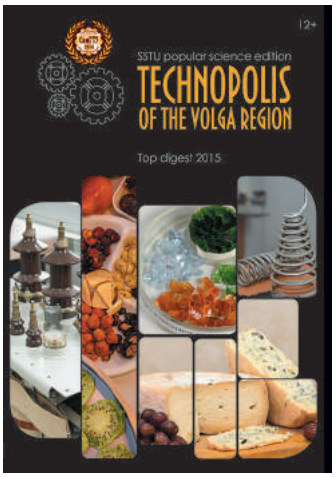
Scientists of the Engineering and Technological Faculty have developed a new method to protect military equipment not only from cumulative but also from the sub-caliber shells, which is unique for Russia. Associate Professor Dmitry Paschenko and Professor Anatoly Schelokov have designed thermochemical energy storage. A group of our researchers have discovered a new technology for pregabalin preparation (a substance used for treating epilepsy and fibromyalgia).

Near the village of New Baytugan our geologists have found parakonulyary, extinct organisms which had conical, cigar-shaped or pyramid-like skeletons. It had previously been thought that konulyary were solitary animals but an unexpected finding in Baytugan layers allowed the hypothesis that they had a colonial lifestyle.

The unique popular scientific journal "Technopolis of the Volga region" provides the information about remarkable people working in Samara State Technical University, their achievements and discoveries. It has been published since 2014 for university partners and friends. We invite everyone to take the advantage of the publication as an open media platform for the strengthening of friendly relations and mutually beneficial cooperation.

editorial text

new part



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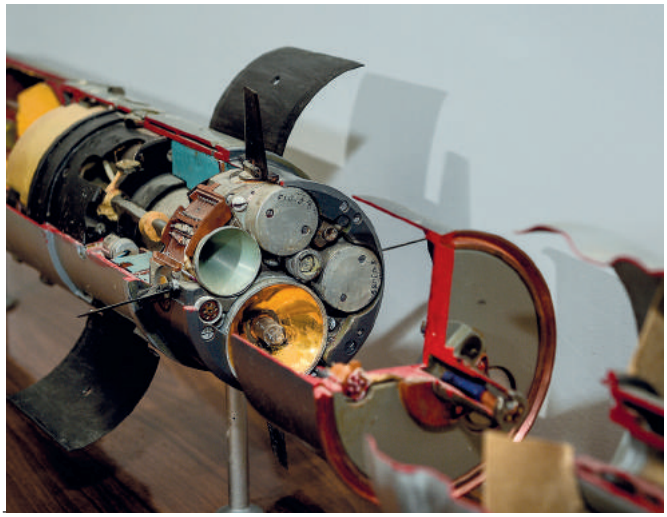
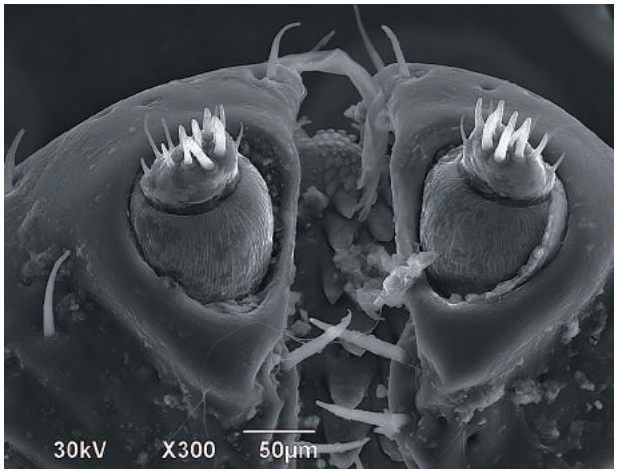


Celestial prediction

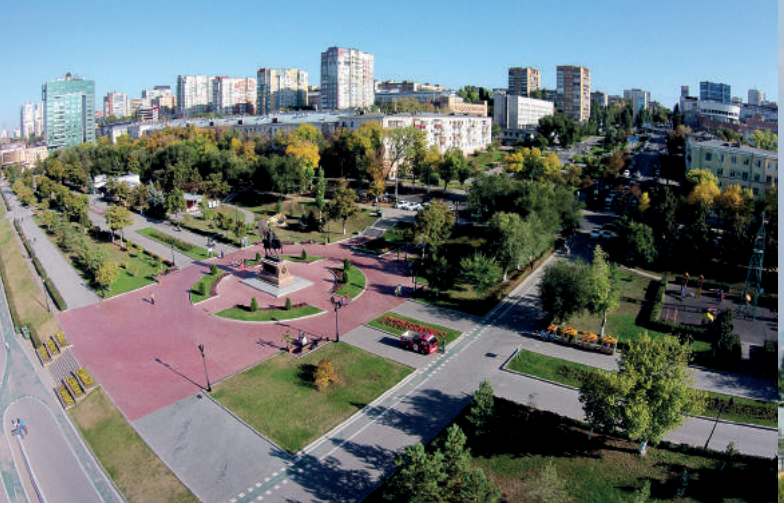
The mysteries of Paraconularia

Light and dark

In the smallest details



No worse than French



SAMARA

JUST NUMBERS

+ **1238** staff
234 external part-timers

1472 Professors & teachers

Employees

Deans	21
Heads of departments	70
Professors	141
Assistant professors	624
Senior teachers	218
Teachers, assistants	164

Teachers with science degree

Doctors of Science	200
Candidates of Science	778

Foreign students

Full-time department	211
Extension department	329

Students of education programs of the higher education

Total	20941
Full-time department	11510
Part-time department	77
Extension department	9354

Students sorted by levels of educations

Bachelors	16095
Specialists	3433
Masters	870
Postgraduates	543

Ranks in 2015

RA Expert''	54
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Indications of Monitoring by 2014

Grants for 100 representatives of the Academic staff	5.34
Number of quotes from publications issued in last 5 years and indexed in information-analytical system of the scientific quoting WebofScience for 100 representatives of the Academic staff	15.45
Number of quotes from publications issued in last 5 years and indexed in information-analytical system Scopus of the scientific quoting for 100 representatives of the Academic staff	17.02

BASKETBALL TEAM "POLYTECH-SSTU" HAS WON A SILVER MEDAL AT WOMEN'S SUPER LEAGUE

On the 28th of April the play-off in the final series of the Women's Basketball Super League was held in Voronezh between the teams of Samara "Polytech" and local "SKIF".

In the last seconds of the game the Voronezh team managed to get 4 points clear of the Samara team. As a result, "Polytech-SSTU" got silver medals in the championship – for the first time in history. The team captain Olga Ovcharenko was acknowledged the best player of the season.

SCIENTIFIC JOURNAL "VESTNIK" IS INCLUDED INTO RSCI DATABASE ON THE PLATFORM OF WEB OF SCIENCE

Scholar & Scientific Research and Intellectual Property Department of Thomson Reuters Media company (an operator of the Web of Science Global Database) and scientific electronic library eLibrary.ru have announced the creation of a new database of the best scientific journals – Russian Science Citation Index (RSCI). "Vestnik SSTU. Series: Physical and Mathematical Sciences" has been included in the 652 publications.

The representatives of eLibrary stated that an archive of all the issues from 2005 to 2015 would appear in the database in the near future.

SSTU IS INCLUDED IN TOP-50 OF RUSSIAN ENGINEERING UNIVERSITIES

The International News Agency "Russia Today" with assistance of the Labour Market Research Centre has scheduled a rating of universities relevance. SSTU ranked 40th among the other 140 Russian engineering universities.

In university evaluation such indicators as the percentage of students successfully employed after graduating from the internal course of studies, the share of income from research activities, the share of educational services provided to third-party companies in general, income of the institution, and the employee's works citation index were considered.

According to the rating's data, 91 per cent of SSTU graduates had been employed immediately after graduating.

SSTU IS INCLUDED IN TOP-50 OF THE BEST UNIVERSITIES ACCORDING TO ARES-2015

According to the annual international rating ARES-2015 Samara State Technical University ranked 49th among the Russian universities. The university was assigned BBB category – that means that SSTU possesses high quality of teaching, research activity and it also implies that graduates of SSTU are in high demand among the employers.

ARES-2015 considers mainly the new statements of the European Standard of Education and European Register of Higher Education Quality approved by European Committee. Besides, the rating is processed automatically so that excludes the influence of human factors on the results.

JAB AND UPPER-CUT ARE EXERCISED IN SSTU

Summer of 2015 was remarkable not only for SSTU but also for the whole city of Samara. At that time the first international boxing contest featuring prize sets by Oleg Saitov was held in SSTU. Organized by a professional boxing club "Polytech-SSTU", it turned out to be an outstanding event in Samara's sporting life.

During the four days of the contest 36 fights were held with 46 sportsmen from several regions of Russia, Kazakhstan and Ireland. In the stands one could notice famous world and European champions and Olympics prize takers: Vasyli Shyshov, Gaydarbeck Gaydarbeckov, Vyacheslav Yanovsky, Eugene Makarenko, Aleksey Tyschenko and, of course, Oleg Saitov. Without his assistance and his sport authority the competition could hardly be so wide-ranging and so impressive.

10 prize sets were up for grabs and in the upshot the greatest number of medals was won by the Russian boxers. Among the winners and prize-takers one could name 5 representatives of the boxing club "Polytech – SSTU". Chingiz Natyrov won the first prize in weight division of 52 kg, Tagir Pirdamov became the first in 81kg weight category and Tymur Pirdamov became the runner-up in the same category. Semyon Leonov became the third in the category of 69 kg and Anton Zaytsev won a bronze medal in the category of 91kg.

SSTU STUDENT BECAME THE IT CONTEST LAUREATE

In September the winners of the All-Russian and regional student contest "IT-Planet 2014/15" received their prizes. At the awards ceremony the most skilled students of IT field of the country were honored.

Eugene Ivanushkin, a student of SSTU Department of Automation and IT received two prizes. In the content "Solutions to socially-relevant problems by simple IT- systems" organized by the AT Consulting Company, Mr. Ivanushkin was awarded the second prize on a country level and he became the first in the Volga Region. Ivanushkin's task included the developing of the automated system for businessmen allowing them to send tax payments information to Internal Revenue Service.

In total, about 11 thousand students and young specialists from Azerbaijan, Armenia, Belorussia, Kazakhstan, Kyrgyzstan, Poland, Russia, Tajikistan, Turkmenistan, Uzbekistan, Ukraine and Finland participated in the contest. Samara Region was represented by 384 contestants.

WINE MADE IN SSTU WAS HIGHLY APPRECIATED IN THE CRIMEA

In September SSTU teaching staff participated in an international scientific conference "Ampelography, genetics and selection of grapes: Past, Present and Future". It took place in Yalta in the National Research Centre for Grape and Wine "Magarach".

The Dean of Food Production Technologies Faculty Vladimir Bakharev and the Associated Professor of Food, Perfume and Cosmetic Production Technology Department Pavel Chaldaev presented wine made from varieties of white grapes which were grown in the Samara Region. Particularly, we are speaking about the so-called Platovsky variety of grapes selected in Potapenko Institute for Winegrowing & Winemaking in Novocherkassk.

Pavel Chaldaev's presentation impressed the participants of the conference, the majority of them were Crimean wine-makers. Earlier it was considered that wine-growing is not developed in Russian regions located to the north of Rostov-on-Don as the wine grape varieties do not grow ripe for this purpose. But the grapes grown in the Samara Region are capable of achieving a sugar rate of 20 percent and this is considered to be a very good figure. The wine produced by SSTU staff was highly appreciated by Russian wine makers.

CHINESE SOUTHWEST PETROLIUM UNIVERSITY IS INTERESTED IN COOPERATION WITH SSTU

On September, 14th the teaching stuff of SSTU Petroleum Engineering Faculty and the delegates from Chinese province Sichuan discussed the potential for academic student exchange. The representatives of China are interested in students of Chemical Engineering and Well Drilling first of all. During the negotiations it was agreed that the universities would exchange up to 5 students from each side. To participate in the exchange program, the students should speak English and Chinese.

SSTU ECOLOGICAL PROJECTS WERE PRESENTED IN LATVIA

The 56th international scientific conference was held in October in the Riga Technical University. Many researchers from Latvia, Finland, Estonia and Russia took part in the discussions of Technogeneous Safety and Environment Protection Workshop. Professor A. Vasyliev, the head of Chemical Engineering and Industrial Ecology Department, gave 2 presentations addressed to the monitoring of the negative effects caused by oily waste and to the assessment of the negative effect imposed by electromagnetic waves onto people.

The researcher from SSTU was the only representative of the Russian university at the conference.

SSTU BECAME THE PARTNER OF THE UNIVERSITIES OF AZERBAIJAN

In September ADA University of Baku hosted an Azerbaijani-Russian intercollegiate forum. 31 representatives of universities' administrations participated in this event. SSTU was represented by the rector Dmitry Bykov. The intercollegiate agreement on collaboration with Sumgait State University and Azerbaijan State University of Oil and Industry was signed.

Besides, during this forum a memorandum on creation of the Azerbaijan and Russian Higher Educational Institutes Association was signed. The Association provides its members with the opportunity to participate in academic exchange programs, students exchange programs, double diploma programs and especially in the programs of cooperative scientific research.

SSTU PROJECTS WERE PRESENTED AT INDUSTRIAL EXHIBITION IN VIETNAM

In December Hanoi hosted the first Russian-Vietnamese Industrial exhibition "Expo-Russia

Vietnam 2015". The researchers of SSTU presented a project of a multi-level system of hyper-spectral monitoring of the Earth. This is a co-project of several departments of SSTU: the Department of Chemical Engineering and Industrial Ecology, the Faculty of Automation and IT, and the SSTU Institute of Mechanical Systems Research directed by Pavel Kuznetsov. The key target of this project is to create a technology capable of reporting reliable data on the state of a particular area automatically, without additional data processing. The research created a classification of hyper-spectral images received from flying vehicles for discovering the areas polluted by oil products.

SSTU STARTED A CHINESE LANGUAGE COURSE

Now the students and the teaching staff of the university have an opportunity to study the Chinese language.

The classes are conducted by Tzeng Ruo Jia who was invited to Samara by the university administration. She is authorized to teach Chinese all over the world by a special certificate issued by the Ministry of Education of Taiwan.

SSTU ECOLOGY POST-GRADUATE MARIA NIKOLAEVA DID INTERNSHIP IN PRAGUE

Maria Nikolayeva, a post-graduate student of the Chemical Technology and Industrial Ecology Department of SSTU did an internship in Czech University of Life Sciences. The internship program is one of the directions of the European project "Erasmus Mundus". The key goal of this project is to enhance students' mobility and improve the quality of higher education due to the financing of academic cooperation between Europe and the rest of the world.

"We have been studying the process of phytoremediation – Maria Nikolaeva says – Professor Dana Komnicova became my scientific advisor. The target of our research was to determine the possibility of purifying polluted soil with the help of plants; and also we tried to study the mechanism of radioactive caesium accumulation by plants' parts. We chose calla as an experimental plant as it is widespread all over the world. The results showed that calla is an accumulating plant that could be used to purify the polluted water and soil from radioactive caesium".

Czech University and SSTU have signed the cooperation agreement that implies active student exchange, research internship programs aimed at realization of co-projects within the Erasmus + project.

SSTU BECAME THE SUPPORTING UNIVERSITY

In January 2016 SSTU became one of the 11 universities to be entitled "the supporting university". It has won the competition organized by the Ministry of Education and Science of the Russian Federation.

The Supporting Universities Development Program is aimed at the creation of high-standard universities on the regional scale. These universities are to attract talented students, create scientific laboratories and provide cooperation between large regional sectorial companies.

Not long before the university won the prize, the academic councils of Samara State Technical University and Samara State University of Architecture and Civil Engineering had decided to unite the two oldest universities of the Samara region under the brand name of SSTU. As SSTU rector Dmitry Bykov says, the united university that received the title of the supporting university will become a powerful multi-functional scientific and educational centre; it will accumulate all the branches of manpower development necessary for current and planned industrial enterprises and objects in the Samara Region: gas and oil engineering, metal treatment and casting technologies, high technology in civil engineering and architecture, modeling and complex technical systems and process managing, advanced weapons and specialized equipment, and defense industry technology.

WE HAVE MANY WONDERFUL OPPORTUNITIES, ZITA PATONAI SAYS

'Electroshiled Samara' counts on leaders

By Tatiana VOROBYOVA

Four years ago she couldn't speak Russian at all. But when she came to Samara she learned Russian 'from scratch'. A new human resource management team at Schneider Electric was also created by her from scratch; this team works with staff in Russia and CIS. Zita Patonai's first-priority task was to work out new corporate policy. As a HR vice-president of market administration 'Energetika' of Schnider Electric in Russia and CIS she told our magazine about changes that had already taken place as well as about her personal and corporate priorities.

On new spot

They weren't afraid of changes. When Zita's husband learned about the Electroshield Samara project she had been working on for several years and that she was going to move to Russia, he said that it was a good chance to try their strength. They had no idea of how hard it would be to start a new life on a new spot. But eighteen months later problems with life conditions were settled, and now the family which came from France with two little kids feels like home in Samara. Zita's daughters – they are 7 and 5 years old now – have already got the feel of our country and speak Russian fluently.

It was also not easy for them to start working at the enterprise that had just joined an international company as its corporate policy was different form modern European standards.

Secret of success

Zita was stricken by extremely formalized processes and enormous number of bureaucratic obstacles. She thinks that this Electroshield feature is not typical for other Russian enterprises.

In the beginning of integration of Electroshield Samara with Schneider Electric, its employees should have changed their vision of many important things.

"First of all, we explained the importance of customer-oriented approach to the personnel," Zita Patonai says. "Electroshield Samara is well-known at the Russian electroenergetic market for its high-quality products. But the employees lacked the understanding of how valuable each client was and how important it was to meet all his requirements because a client pays money for our products and this money go to salaries, corporate training and company development projects. Second, we needed to teach our people to take the initiative and responsibility and not to wait for a command as they did before. Today, within a new corporate culture, we are expecting them to make suggestions about improvement

of our activity. Twice a year we question all Electroshield Samara employees and they give their opinion on what's going well at the enterprise and what's not. We consider all comments and adjust to them as much as possible."

The main object that the personnel vice-president set herself at the first stage was to make managers of all levels understand that the employees were the most valuable element of the company as success of business depended on them. It is impossible to succeed if an employee is incompetent, not involved into company processes and not interested in results.

Make way for leaders

Schneider Elecric brought the concept of leadership to Elektroshield Samara.

"Starting from 2013 we have involved more than 150 leaders – experts of the highest level – into development of areas that hadn't existed before at Electroshield: marketing, project management, tendering, personnel management, controlling; we trained them. In 2014 we spent more than 40 million rubles on training. More than 3000 employees underwent training in 2015 alone," Zita Patonai says. "It's huge investment."

Detection of leaders and development of leadership is one of the main areas of Electroshield Samara corporate policy today. The objective for chiefs of departments is to set goals for each employee; these goals may be not very easy to achieve but they are clear and allow an employee to show his potential. The employee also gets the opportunity to choose the ways to achieve these goals by themselves; by doing this they rely on expertise and their chief's help.

Corporate electronic resources are very helpful for this job. Some programs help set the goals, register and evaluate the results obtained, others allow an employee to plan professional development measures together with his chief. This system is absolutely transparent; it has never been used at the enterprise before.

Leaders are found among young specialists too. They are familiar with new digital technology; what's more, they want to implement it into production and control – for example, they are ready to develop an application that will allow the adjustment of a transformer via cell phone. Young employees are expected to come up with new effective attitudes to work.

Traditions and innovations

New corporate policy makes the international company attractive for its present and future employees. Legal salary paid on regular basis, bonuses for achievements, transparent processes, career progress, full social package, voluntary medical insurance, life and health insurance – all this is only a part of what Electroshield Samara offers as one of the biggest employers of our region.

Moreover, the company offers various health promotion programs to its employees and takes care of their work and life conditions.

Zita Patonai is sure: "If we want our employees to work well we must provide them with appropriate conditions."

It's no surprise that the personnel become more and more interested in results of their work and gets more involved in company's activity. Surveys show that significant role in it is played by that corporate culture which the employees appraise and consider as one of the company's achievements.

One of the most dramatic changes is that after 2.5 years of integration the employees have learned to evaluate themselves objectively and face their disadvantages.

Another change is evident. Personnel – both involved and not involved into financial processes – have become more economically literate. People started to use words like order marginality, internal efficiency, expenditures for support functions. It is another element of corporate culture.

"But we must not forget that Electroshield is 70 years old and that we should not only implement new approaches but also preserve good traditions," Zita Patonai believes. "For example, prompt decisions made on basis of situation analysis which has always been one of key features of Electroshield employees. There are wonderful traditions of celebrating the professional holiday – the Power Engineers' Day – and place the pictures of the best employees on the company's wall of fame. What has changed is nomination criterion – now its corporative criteria important for company's development"

Three years of integration

"Three years are not enough to change corporate culture," Zita says. "We have just started to get results. But I believe that even ten years later I will say: we have succeeded in his area but that one still needs improvement."

Establishing close cooperation between different departments is one of the company's goals now. But this process is not as fast as company's authorities want it to be.

Have the business results of Electroshield Samara changed over these three years? In Zita Patonai's opinion, the company's huge achievement is that during the crisis on Russian market it lost neither customers nor key specialists necessary for long-term success.

"In 2013 we switched to international standards of financial statements, and index of Electroshield Samara as part of SchneiderElectric is considered even by French exchange which compares it with the results of the company's subdivisions in other countries. After Electroshield Samara joined Schneider Electric, Russia has become the fourth key country for the corporation after France, China and the USA," – says the personnel vice-president. "But we can become the third if we keep implementing innovations and advancing the production."

These three years have been useful for Zita. In her Russian colleagues' opinion, she has obtained new personal qualities and learned to understand the peculiarities of Russian culture and way of thinking while trying to bring European corporate culture to the Samara's enterprise. As a business leader, Zita Patonai can prevent corporate standards from colliding with the mentioned above.

She is exacting towards herself as well. When asked if it's difficult for her to combine working responsibilities with family life she answers honestly: "It's difficult but I'm lucky: my family and friends help me a lot. The main thing is to set priorities appropriately and make up working schedule. I won't spend more that five minutes on something that is not very important."

The vice president is proud that she has managed to form solid team at Electroshield Samara; a team where everybody knows what they're doing and speaks the common language – both in the literal and metaphorical sense. She is proud of the united employee service backup center created to provide HR management for Schneider Electric employees in Russia and CIS.

"She has one more secret," the company's corporate communications manager Margarita Kiselyova says. "Zita never says 'We have a problem'. She says 'We have many wonderful opportunities!'"

ГРУППА КОМПАНИЙ ЭЛЕКТРОЩИТ ТМ-Самара

PRODUCTION OF HEAVY OIL WILL BECOME EASIER

By Alexandra ISHIMOVA

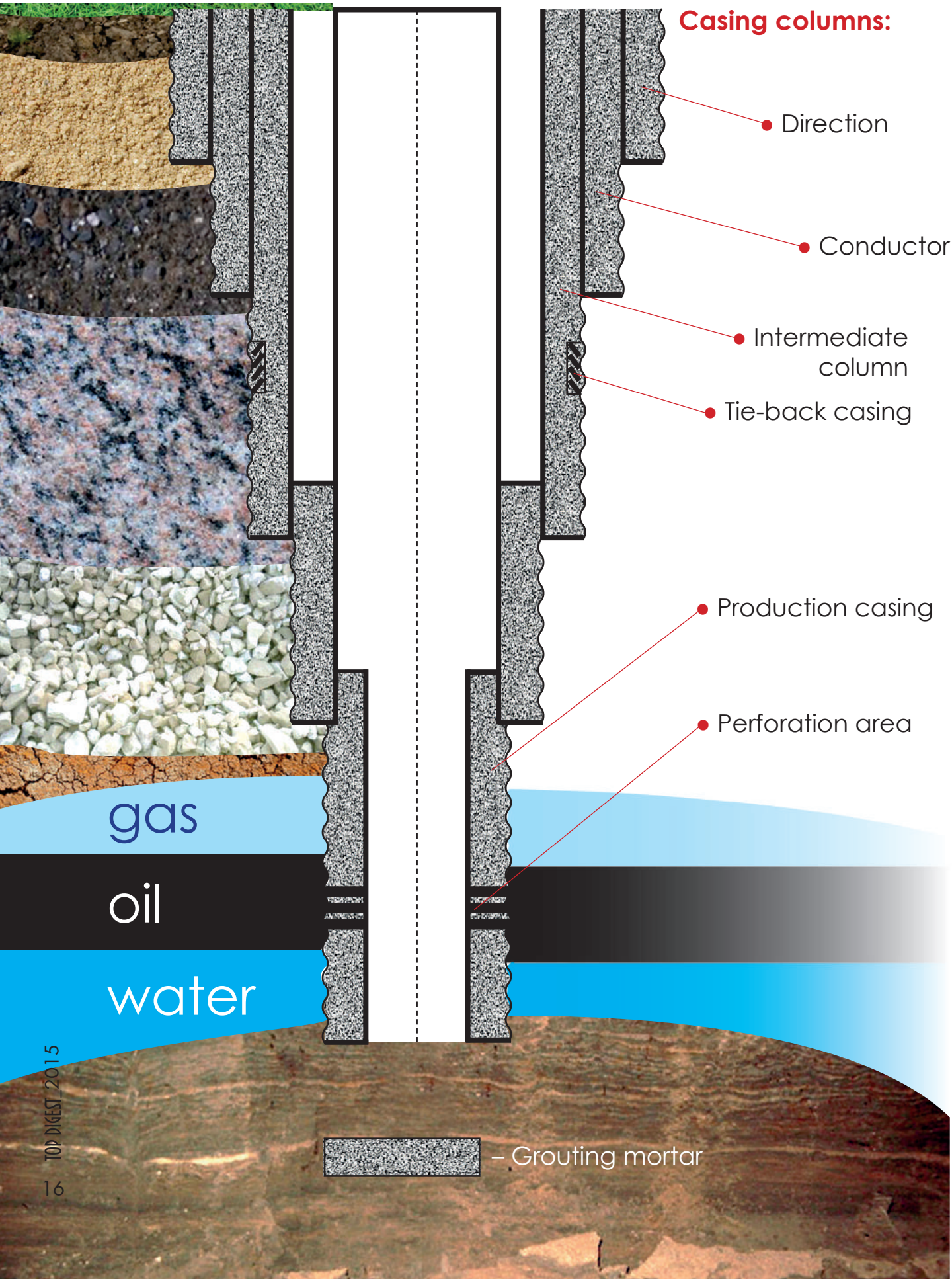
Oil is a very valuable Russian product which still brings big profit; oil production and refinery provide a major share of taxes paid to federal budget. Today one of the factors that cause growth of 'black gold' production is adverse conditions of production. Modern achievements of the Chair of Drilling at Samara State Technical University are able to give impetus to the oil industry development.

Search and pump

In the USSR and then in Russia the main way to increase oil production was and still is to expand the oil production area, up to the northern sea shelves. However, specialists think that mass media statements about big shelf oil deposits are rather exaggerated. By their estimate, these deposits are no more than 10-30 million tons and most part of this amount is natural gas.

Another way to keep high rate of 'black gold' production is to increase oil production from deposits that have already been explored. However it hasn't been paid much attention to. Oil recovery factor (ORF) in

Scheme of well cementing by grouting mortar



Russia is the lowest among leading oil-producing countries – 0.35-0.37. It means that more than 60 per cent of oil stays underground after development. In other hand, even 0.1 per cent increase of ORF will allow to produce oil in Western and Eastern Siberia 20-30 years longer without going to shelf.

Today more than a half of explored deposits in Russia are hard-to-recover reserves; more than 30 per cent of this amount is high-viscosity paraffin oil. Experts admit that these deposits must be put into production use as soon as possible. This necessity is caused by growing demand for hydrocarbons while deposits with 'favorable' rheological properties (plastic and dynamic viscosity; dynamic stress) decrease.

Drilling muds and much more

Vera Zhivaeva, Candidate of technical sciences, associate Professor, head of the Chair of Oil and Gas Well Drilling told us about current SSTU research work aimed at making oil production easier.

"One of the issues our chair is working on is to penetrate layers with complex geological cross-sections," she explains. "It is especially important for production in Western and Eastern Siberia, particularly for Vankorskoe and Bovanenkovskoe oilfields that are very difficult form geological point of view."

New advanced technology is required to penetrate unstable rocks and productive strata, as well as for retention of porosity and permeability properties of the latter. Scientists at SSTU are working on this problem under the contract with 'Rosneft'.

Not long ago the Chair of Oil and Gas Well Drilling got orders for testing drilling muds for 'Service Oil Company' and 'Akros'. Tests are performed in the SSTU laboratory at the FANN equipment in compliance with ISO and API standards. This is the only laboratory of such kind in Samara region so its services are in great demand.

By the way, cooperation with Akros includes professional training for employees as well.

Tight connections have been established between the Chair and Moscow company 'Special drilling muds' which produces a wide range of reagents for drilling muds and grouting mortars. Lecturers tell about the use of these reagents during their professional training lections. It is particularly important for dealing with import replacement issue. Previously import reagents were bought instead of Russian ones without any reason for it; Russian reagents are as good as foreign equivalents and sometimes are even better as they allow choosing certain composition of drilling mud easily with consideration of features of particular wells and oilfields.

"Drilling muds are developed by research institutes, specified in project documentation and may vary because of properties of penetrated strata at certain depth," Vera Zhivaeva says. "As contractors, the SSTU scientists also come up with their own ideas. Each newly-developed drilling mud undergoes laboratory tests and than gets a certificate of compliance with all necessary parameters."

Specialists at SSTU also develop their own compositions for drilling muds. Research work done at FANN equipment allowed four postgraduates under Zhivaeva's guidance to defend their dissertations. Research on subject called 'Development of new drilling muds and providing them with necessary properties' can be called endless as the number of new reagents is constantly growing.

Drilling mud (suspension) cements the well walls and resists strata pressure. It is the basic operating fluid which makes the drilling process possible. The mud is to hold the rocks all the way down through the well which is a deep hole of small diameter; the well gradually narrows to the bottom. In order to produce the desired product, the mud must not damage the stratum; it should preserve its natural reservoir properties by not disturbing pore volume.

The Chair of Drilling at SSTU is considered to be the leading one in Russia in the area of rocks properties research. Results of experiments carried out by our scientists allow them to choose a proper drilling mud with consideration of rock pressure in order to penetrate productive stratum with minimum loss of its porosity and permeability properties. Special software was developed at SSTU to project the composition of drilling muds. The SSTU scientists have record of successful calculations for oilfields in Eastern Siberia and the Orenburg region.

Specialists at the Chair of Drilling in SSTU have developed a project of a device that is able to measure the wear-out of drill column. Development of this device is sponsored by the Fund for supporting small enterprises in scientific and technical area within the 'Apprentice' program. The invention will be patented.

From well to well

Specialists at SSTU have been working on improving the quality of well casing since 1980's.

"The casing is cementing the well using proper grouting mortars," Vera Zhivaeva explains. "The main goal here is to prevent cross-flows between the columns and estuarine occurrences. The elimination of these effects poses a problem practically on every oilfield."

After drilling each interval of stratum with quality mud, the well is cased by moving down steel casings connected to each other to form a column. Grouting mortar is pumped between the column and well walls. This mortar contains cement, water and certain reagents to give it necessary properties.

If the well is not cased properly it will require major repair in six months. This repair is very complicated and expensive. That's why it is important to make a cement composition that well adjoins both casing and well walls thus eliminating all undesirable cavities that may cause cross-flows between columns.

Every year about 300-400 specialists graduate from the Chair of Oil and Gas Well Drilling. Employees of corporate institute 'Rosneft'-'SamaraNIPIneft' also take part in education of specialists. With support of 'Rosneft' Samara State Technical University became the first university in Russia that started to train specialists for shelf drilling. Within this project, new joint programs for masters and postgraduates are created; the core chair - the Chair of Well Construction and Workover Engineering – was established. The Chair is headed by **Azamat Ismagilov**, Candidate of economic sciences, who is a managing director of two design institutes: 'SamaraNIPIneft' and 'Giprovostokneft'. The specialists are to undergo further study concerning field production on shelf, as well as training the students for dealing with new issues of oil production.

Alexander Goryachev, deputy general director of legal coverage and marketing at 'Giprovostokneft':

"Many oilfields with hard-to-extract reserves with deposits of up to 10 million tons of high-viscosity oil that are placed on production today are characterized by big content of paraffin and hydrogen disulphide, low-permeability collecting properties, etc. In order to increase oil recovery factor we need to implement methods to enhance oil production by means of hydrocarbon solvents, carbon dioxide, micelle solutions, surface-active reagents, polymeric solutions and by changing temperature

▲ Alexander Goryachev has been designing oil-production facilities for more than 30 years.

conditions of oil displacement process. Methods that utilize steam, particularly pumping stem into stratum by steam generators, have proved to be rather useful for displacing high-viscosity paraffin oil."

However, production at Kenkiyak oilfield proved that Russian steam generators are inferior to foreign equivalents. Problem of modification has not been solved yet as it's impossible to develop domestic machine building without 'General development guide…' and resorting to services of major project institutes. The same problem concerns another type of domestic oil production equipment that is the compressor stations. That is why it's necessary to start developing 'Scheme of oil and gas producing regions development…' again and involve all participants of Russian oil and gas market under the guidance of the RF Ministry of Energy. This will allow the cutting of the oilfield infrastructure development costs significantly and, what's more, the prediction what kind of equipment oil production industry will need.

For example, designing compressor stations. Proper marketing system allows a foreign company to supply this equipment with consideration of individual field changes for particular oilfield much faster than a Russian manufacturer.

Gathering and transportation of oil

In 2011 the 'Giprovostokneft' institute patented its method of collecting and transporting multi-phase mixture from distant clusters of wells. Their method of sealed collection using multi-phase measurement devices and pump stations allows the recuction of operating and repair costs and the elimination of common booster pipeline pumping stations. Oil and gas are pumped through the single pipeline. Gas is transported to central gathering plant together with fluid; this helps to solve the problem of fluid recycling. This method preserves production energy for a long period of time, extends a period of oil well blowing and increases cost-efficient oil recovery.

According to the developed scheme, multi-phase measurement systems are supposed to be used; they are to define the proportion of oil, water and gas without separating them.

The system includes multi-phase pumps for out-of-pipeline transportation; they pump practically all kinds of viscous liquids and with almost 100 per cent content of gas.

Use of multi-phase pump stations seems to be one of the main ways of gathering and transportation of oil and gas in regions without well-developed infrastructure and complicated climate conditions, including the Arctic shelf regions. As for the shelf oilfields, this scheme will reduce the quantity of pieces of equipment thus making offshore drilling platforms much more compact.

EXPLOSION WITH NO REGRETS

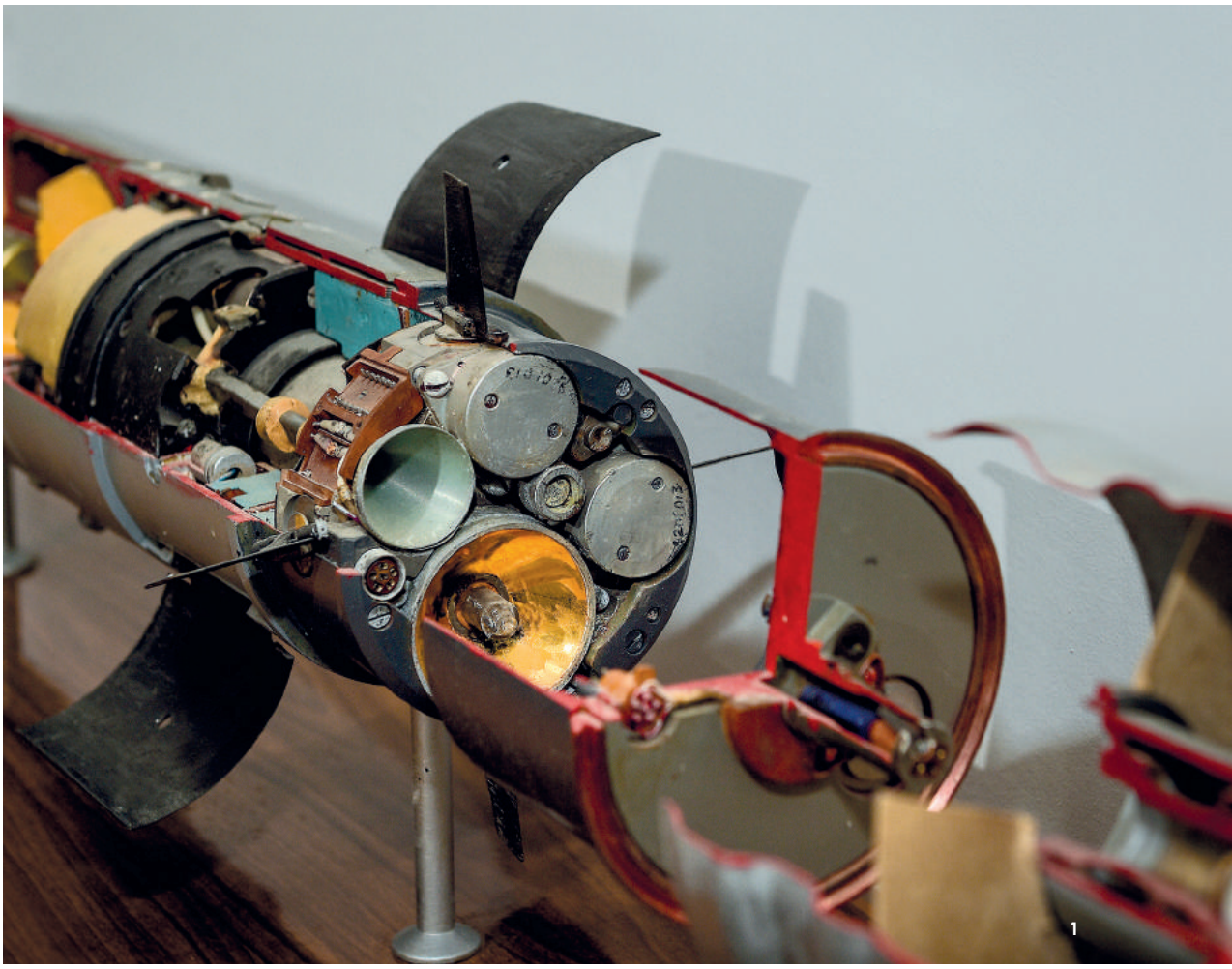
Scientists of Samara State Technical University developed a universal rolling method which allows the production of linear-shaped charges of any length and yield

By Svetlana EREMENKO

The Engineering-Technological department founded in 1943 now trains specialists for enterprises that produce and use explosives. Its specialists work on research and development of advanced technologies that can be used to in various types of weapon. They also work on the conversion problem, i.e. turning dangerous substances into materials needed for civil production. We discussed the current scientific trends of the Engineering-Technological department with its dean Andrey Kerov as we took a walk along the museum full of training shells, torpedoes, mines and air bombs.

Powder tears apart, powder unites

Charges developed by the specialists of the department are used extensively both in oil production and mining industry. Here the Professor demonstrates the section of a pipeline with walls 1.5 centimeters thick. The opening in it is cut by directed explosion of powerful extended linear charge rather than primitive cutter. Museum posters and displays show various types of cumulative charges developed by the SSTU specialists. Linear-shaped charges are widely used in oil and gas production. Explosion method is also useful when it is necessary to reinforce the weld seam of an oil-trunk pipeline while replacing its section. Common procedure – mechanic cutting by roller – takes the whole day. Procedure developed by the specialists of the Engineering-Technological department takes only about an hour. Here is another piece of useful equipment for oilmen – a perforator which utilizes the cumulative charges to build up a system which lets the oil go to the well. The SSTU specialists also took part in demolition of radio center towers in the village of Novosemeikino in 2010, 20-tonn oil tanks at the Kuibyshev oil refinery plant; they also helped to destroy foundations, etc.



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Salute to Mars!

The scientists at SSTU are the only Russian specialists who have the patent for development and production of linear-shaped charges using the rolling method. The method is as follows – a pipe of a certain diameter is filled by explosive material and then rolled; rolling provides the proper cross-section shape of the pipe.

"Using this method we can produce longer and bigger charges," **Andrey Kerov** explains. "We are able to manufacture charges up to 2 meters long. Let me tell you the truth – I think that this is one of our most successful products that will be in use for many years. And not only for military use or national economy needs. I dare to think that our technology will be used for exploration and production of fossils on other planets!"

Hiding from explosion

Passing by the display with the collection of mechanical fuses (which moved to the department museum after the Maslennikov plant was closed), Andrey Kerov approaches the display called 'Localization of damaging effect of explosion by use of perforated protective devices'. He tells the story: 10-15 years ago the department specialists designed and tested a protective facility able to localize the damaging action of explosion. They developed a snap-together structure to be used to protect buildings while demining cars or disarming bombs planted by terrorists. In the early 2000's there was SSTU-based production

of bullet- and blast-proof cabins that were in demand in organizations that needed special protection, particularly banks.

Our armor is strong

Another display shows a naval mine called 'Crab'. It is cut in two. The specialists of the department managed to do it with surgical precision: the 'stuffing' – explosive – is falling out but not exploding.

"We used the method of vibro-inductive melt by cumulative charges. Explosive extracted from the mine can be recycled to produce industrial explosives; recycled powder, for example, can be turned into lacquer and paint," Kerov explains.

But the most interesting and prospective trend for the scientists to use the recycled material is to use the recycled explosive in innovative spheres of technology. Namely, the method of detonation sputtering of wear-resistant coating which significantly extends operational life, especially in severe operation modes (drilling tools, dies etc.). Russian ammunition must be more resistant to external action and safer for people who handle it. And so must be battle vehicles, guided-missile systems, etc. Practically all specialists of the Engineering-Technological department have been working on this task which was set for the Russian defense industry.

Research in the field of explosive reactive armor for armored vehicles (e.g. tanks) is also in this trend. This protection must go off when contacting with destruction means.

"We developed a new way to eliminate some defects in the protection system of armored vehicles. Our product can protect military vehicles not only against cumulative shells, but also decalibrated projectiles which pose great danger as they quite often penetrate explosive reactive armor of tanks," Andrey Kerov comments upon his colleagues' success. He also points out the invention of SSTU engineers has no competitors in Russia in terms of quality-price ratio.

By the way, the latest military products developed by SSTU were shown to the commission from Ministry of Defense of Russian Federation during its visit to the University in August. Test results were reported to the Ministry. Some experts think that there is a chance for the University to get an order from the Ministry of Defense in the near future.

1. Samples of ammunition serve as teaching aid for the students of the Engineering-Technological department.

2. SSTU-designed cumulative charges for exploration seismology are used by geologists.

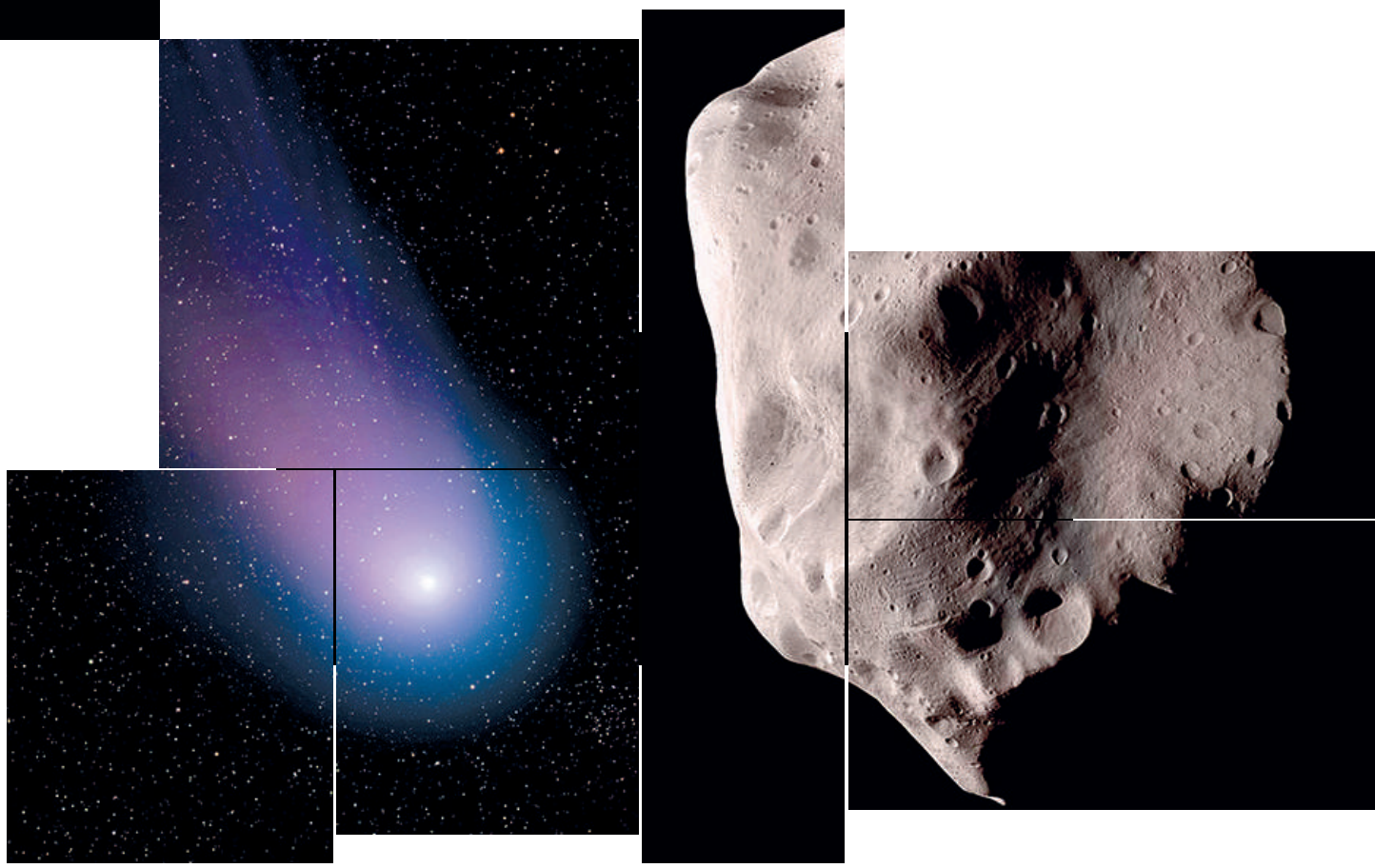
3. Case of a shell is being cut by cumulative charge (right) using the method developed in SSTU.

4. Students of the Engineering-Technological department study the characteristics of explosives using the Bichel closed explosive bomb.

CELESTIAL PREDICTION

Calculations done by the specialists of Samara State Technical University allow the forecasting of danger posed by minor celestial bodies

By Svetlana EREMENKO



We make a wish when we see a meteor flashing its way across the sky. In contrast to most people, scientists from Samara State Technical University, father and son **Anatoly Zausaev** and **Artyom Zausaev** don't find words like 'meteor', 'asteroid' and 'comet' romantic. They have developed a unique program which includes the asteroid database. This program makes it possible for the scientists all around the world to calculate precisely the orbit evolution of more than ten thousand celestial bodies. Modern scientists are sure that one of them hits Earth every million years causing a catastrophe. After the Chebarkulski meteorite hit our planet in the beginning of 2013, astrophysicists became extremely concerned that celestial bodies could do the same and destroy life on Earth. The Zausaevs say that now it is quite possible to make a 200-year forecast for dangerous activity of space bodies at the asteroid zone between Mars and Jupiter, as well as to predict the behavior of asteroids affected by attraction of all nine planets of the Solar system.

Everhart method

In 1972 when Anatoly Zausaev worked at the Astrophysical Institute of Tajikistan Academy of Science he attended astrophysical conference where scientists from all around the world were discussing issues of 'universe research'. Among the outstanding scientists (one of them was Professor Yan Oort from the Netherlands who discovered the area in the universe where the long-period comets used to form) there was an American mathematician Everhart. He was imbued

with the problem of celestial mechanics and realized that astrophysicists still got no method for numerical integration in minor celestial bodies of the solar system. After a short period the American scientist sent not only formulas but also a computer calculation program to observatories all over the world, including the one Zausaev worked in.

Researchers of the Chair of Applied Mathematics and Informatics at SSTU have developed a modified mathematical model for movement of big planets, the moon, the sun, short-period comets and asteroids; this model considers gravitational and non-gravitational forces, relativistic effects, effects of planet non-sphericity. They also developed a piece of software to solve differential equations of celestial bodies motion by using modified Adams and Everhart methods as well as advanced Taylor development method; they created new high-precision database containing coordinates and velocity of big planets, the moon and the sun within time range from 1000 to 3000 A.D. Specialists at SSTU also calculated and analyzed the orbit evolution for about 10 000 asteroids from the Apollo, Cupid and Aton groups within time range from 1800 to 2206 A.D. and about 240 registered short-period comets, detected about 1300 objects approaching Earth at the distance less than 0.01 astronomical unit; they developed a piece of software to automatize the process of studying the movement of minor bodies of the solar system within any range of time. Results obtained by the SSTU specialists were published in more than 50 scientific works.

"Since then I've been studying asteroids though the subject of my candidate dissertation were meteors," Anatoly says. "Meteor study doesn't require high-precision calculations. And I was interested in precise calculations. Today we can use laser equipment to measure the distance from Earth to the Moon with 15 cm tolerance. Back in those days we would use theodolite and the tolerance could be 50 cm for each 2 km of distance! At first we calculated everything using one of the first USSR computers – 'Minsk-14'; it employed vacuum tubes. Later we switched to a semiconductor machine called 'Large Electronic Calculator -6'. I remember that in order to get the coordinate database of celestial bodies from our French counterparts we had to take two huge reels to the airport. Their storage capacity was only 29 MB!"

Later computers began to evolve very quickly as well as astrophysics itself. Four observatories would watch the space in the USSR. There was a department which was searching for new asteroids; it was headed by **Nickolay Chernyikh**, astrophysicist. Every year Soviet scientists used to discover more minor celestial bodies than their counterparts in other observatories in the world. The largest and most authoritative asteroid study institute was situated in the USSR.

The first stage of the research on subject called 'Development of high-precision numerical theory of movement and investigation of orbit evolution of minor bodies of the Solar system' was completed by two scientists of the Astrophysics Institute of Tajikistan Academy of Science – Anatoly Zausaev and **Alexander Pushkaryov** – in 1990.

"We used the asteroid number 4179 called Tautatis as the object of our investigation," Anatoly Zuasaev says. "Our scientific report contained results of alteration of its motion orbit over many thousands of years. These alterations showed that this 'rock' could hit Earth. No surprise that mass media all over the world used to say that in 1992 Tautatis would pass at dangerous distance from Earth. Precise calculation was required and we did it. The result that we got was encouraging: the shortest distance the asteroid could approach Earth was 718000 km."

On the 8th of December 1992 and the 29th of September 2004 theoretical calculations were confirmed. The celestial body appeared where it was supposed to appear.

Operation 'Interception'

After explosion of the meteorite over Chelyabinsk the President of Russia Vladimir Putin, the vice-premier Dmitry Rogozin and the head of the Ministry of Emergency Vladimir Puchkov said that a system should be created to detect the space objects that pose potential danger to Earth. Roskosmos is going to set up a system to protect Earth against asteroids, comets and other dangerous space objects. It is scheduled by the Federal space program for 2016-2025. It's understood that precise calculation of trajectory of a celestial body is the most important aspect in assessment of risks associated with potential catastrophe. Specialists who design this system may face some problems. Anatoly Zausaev says that there are no telescopes left in Russia that are able to find small space bodies: all the USSR observatories were built on the territories that now belong to the former Soviet republics. Construction of our own observatories require much more money than all the money given for protection against comets and asteroids.

But even the most powerful telescopes can't detect the dangerous asteroids if they approach from the side of the Sun. It's also impossible to hide the population of the Earth into underground shelters in case of approaching Armageddon. It means that dangerous objects must be

intercepted in space before they reach Earth. That is where achievements of the scientists from Samara can be used.

Today scientists from Western countries are the key players on the field of watching the celestial bodies: new astronomical objects are chiefly discovered by astronomers who work in major observatories in the USA, Europe and Chile. Scientists from Samara have to use data provided by NASA. Nevertheless, the SSTU specialists are able to forecast orbital evolution for each of ten thousand asteroids included into special database up to 2206 using the modified Everhart method.

Aggressive Apophysis

Artyom Zausaev says that asteroids used to fall on Earth before and they will keep falling:

"Of course, the probability of hitting is 1 to 100 000. But take a look at the Moon or Mars through the telescope: they are all covered with craters after space 'bombings'. Such craters can be found on Earth too but they are covered with grass or trees. In 1994 the astronomers watched the Schumacher-Levy comet falling on Jupiter – the power of resulting explosion was equal to tens of thousands nuclear bombs. So it's clear what will happen if a similar object crushes into Earth."

Meanwhile the scientists warn about the 50-million-ton minor celestial body Apophysis (named after the ancient Egyptian snake-destructor) which is ready to 'visit' our planet on Friday, the 13th of April 2029. The asteroid will go past Earth at a very close range – closer than some artificial geophysics satellites. We will be able to see it with naked eye. When Apophysis approaches Earth, gravitation of our planet will affect it's motion and slightly displace the asteroid from its orbit. Nobody knows for sure what effect it will have upon Apophysis. But it probably will crush into Earth next time – in 2036.

Anatoly Zausaev believes that this asteroid must be displaced form its orbit in 2019, otherwise mankind will be unable to prevent the attack from space. According to calculations done by NASA, a kinetic ram weighing one ton must be sent to meet the asteroid and it will displace Apophysis from its orbit. Other scientists think that only nuclear charges can deal with this enemy from deep space.

"The problem with all these assumptions is that they require much time in reserve and much money. But none of these plans will come true until people realize the menace," Anatoly Zausaev thinks. "Every object larger than 3 m which is presently crossing the Earth's orbit can get to the point of collision with our planet any minute. But, to be honest, I'm more worried about the luck of scientific brainpower in our region rather than menace from space. Old scientists leave, young people get job in banks and private companies and nobody is interested in what's going on in the sky anymore."

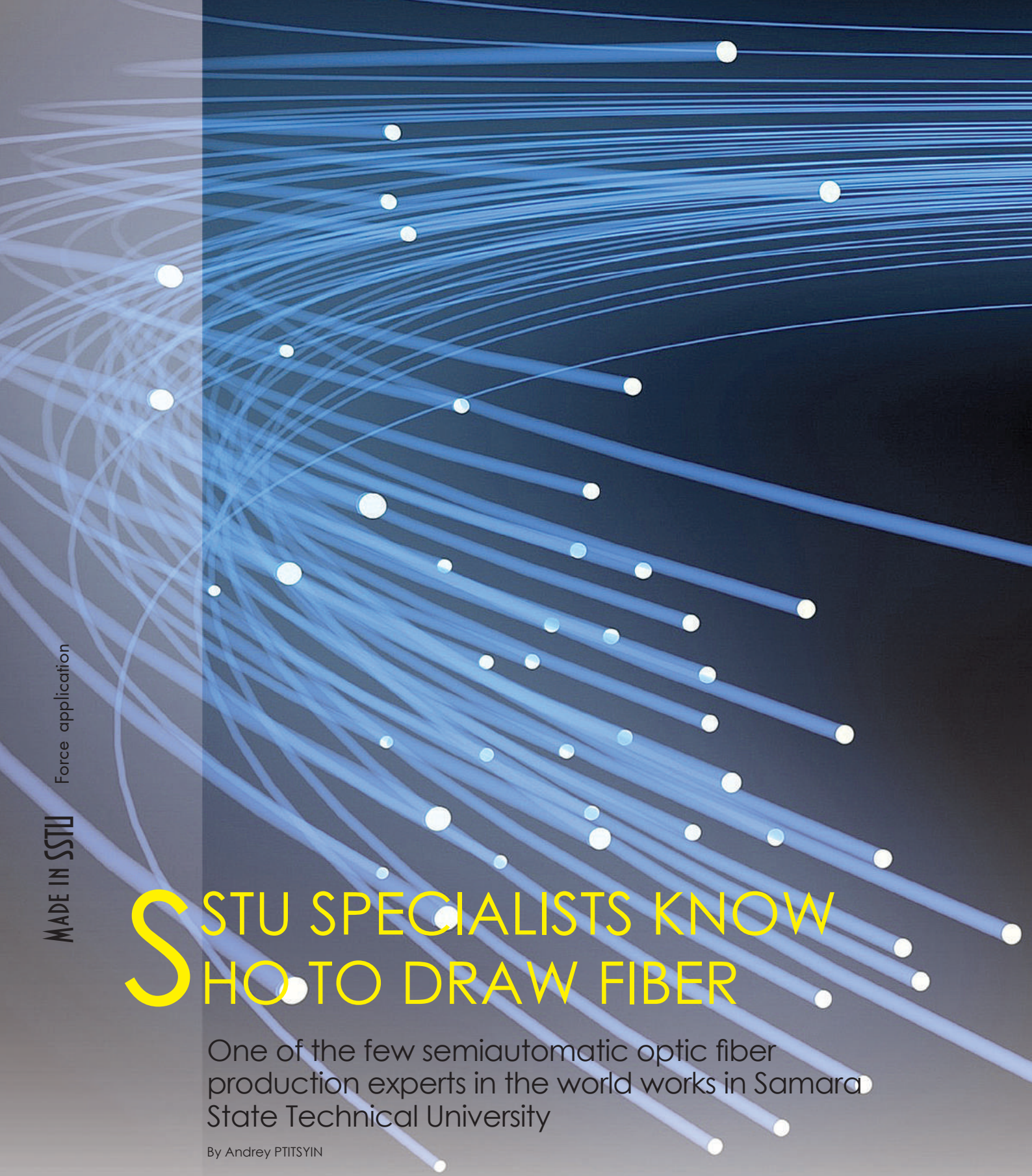
But on the other hand, the achievements of our scientists are used by specialists from more than 50 countries. Counterparts from both Russian and foreign countries know about the web site www.smallbodies.ru developed by students, postgraduates and specialists of the Chair of Applied Mathematics and Informatics at SSTU under the guidance of Anatoly Zausaev. This internet resource is a unique project which contains detailed data about space objects that pose danger to Earth, as well as extensive lists of asteroids and comets. Information about position of minor celestial bodies is updated every 100 days.

Meanwhile

Sergey Averyanov who graduated from the Oil-Technological department of SSTU came up with idea of building an observatory in Samara.

"Stars are attractive for many people but, unfortunately, we don't even have a planetarium in our city," Sergey explains. "A powerful and quality telescope is required to see the colors and shapes of nebulas and galaxies; ordinary people can't afford it. And even if they did, what could they see in their telescope from the center of our megapolis?"

Inspired by the photographs take by other enthusiastic astronomers, Sergey decided that he should try to create a professional observatory to watch the stars from Samara via the Internet. He plans to get money by crowd-funding. The observatory is supposed to be built outside the city limits, near Krasny Yar. It will employ the Sky-Watcher BK P2001 telescope. This telescope will allow people to not only watch the stars at night but also to look at the sun and take high quality pictures of the starry arch.



SSTU SPECIALISTS KNOW HOW TO DRAW FIBER

One of the few semiautomatic optic fiber production experts in the world works in Samara State Technical University

By Andrey PTITSYIN

Today there's no Russian-made optic fiber in our country. Firstly, even though there's a plant in Perm, its production rate is very low and cannot be called even 'a drop in the ocean'. Secondly, it produces optic fiber for special purposes. Thirdly, the basic property of Perm fiber – attenuation rate – doesn't meet the international requirements as it's not low enough. Meanwhile, today optic fiber is essential for practically all branches of industry and economics, starting from telecommunications. As we know, data throughput of Russian internet is far from being perfect, and in many ways it is caused by technically obsolete communication lines which are based on fiber optic cables.

Threat to national security

Finally the government paid attention to this problem. International sanctions against Russia led to the concept of import substitution, particularly in the area of optic fiber manufacture.

In one of his interviews to federal mass media the deputy minister of industry and commerce of the Russian Federation **Victor Evtukhov** noted that timely deliveries of the necessary amounts of imported goods for a number of industrial branches couldn't be guaranteed nowadays which was a major menace to national security.

"We already faced the situation like that in early 2000's when our optic cable manufacture ceased because our Western partners limited and suspended the delivery of their production," says **Timur Kotlyar**, Rosnano head of project monitoring.

Newsmakers began to make such statements after the Ministry of Industry and Commerce had decided to include optic fiber – which is used in the manufacture of optic cables – into the import substitution program.

"This year we will launch a plant called 'Optical fiber systems' in Mordovia; it's invested by 'Gazprombank', 'Rosnano' and the government of the Rebublic of Mordovia. Amount of investment is 2.7 billion rubles. The plant in Saransk should become the first Russian enterprise that manufacture optic fiber which is a key component of fiber optic cables. This plant will become one of the first steps in implementation of Russian import substitution program and the first stage in manufacture of entirely Russian fiber optic cables," Victor Evtukhov noted.

Major companies like 'Rostelecom', 'Mobile TeleSystems', 'Megafon' and 'Yota' are ready to be end-users of Russian-made fiber optic cables. So are some departments and big state corporations like 'Federal Network Company', Russian Ministry of Defense, Russian Ministry of Internal Affairs and Interdepartamental Electronic Document Management system.

Developers' knowledge

Investors admit: at first our prices will be higher than those of American and Japanese competitors. Technology also matters. Our manufacturers have no experience of optic fiber production yet. But there's another problem. **Boris Chostkovsky**, Doctor of Technical Sciences, Professor at the Chair of Automation and Control in Technical Systems, told our magazine about it. The world-renowned scientist is not certain about the success of the Mordovian project because infamous 'Nokia' strived hard for participation in it – and finally did.

Chostkovsky says that when he was a fifth-year student of SSTU, R&D Institute of cable industry of the USSR asked SSTU to develop a project of extrusion line – equipment for putting polyethylene isolation on copper wire.

"Specialists of our laboratory developed all automatic devices and ran the line. And suddenly we received a bonus which was too big for that time. It turned out that that R&D institute sold our project to 'Nokia'. Later Nokia specialists adjusted the SSTU-developed project for Finnish components, began to manufacture those extrusive lines themselves and ship them to Russia! For example, Samara Cable Company still uses their line," Boris Chostkovsky told us.

The scientist is confident: cooperation with the company that buys 'know-how' from other firms is not quite right when running a new Russian business project. What we need is developers' knowledge. The point is that if we even start looking for such specialists in Western countries, foreign experts will likely recommend us to take a look at... Samara State Technical University and its project of automated fiber drawing tower developed by Boris Chostkovsky's R&D team and implemented in many countries of the world.

Boris Chostkovsky's colleagues at the industry-based research and development laboratory #8:

Vladimir Tyumkin developed a brand-new contactless optical sensor for measuring diameter of extruded isolation. Oleg Bryukhanov developed a unit-length capacitance sensor which allow the estimation of dielectric conductivity and degree of porosity of foamed insulation. Alexander Milovanov developed a three-phase unit for thyristor control; the entire power contour of extrusion line electronics was based on it. Later the unit development scheme was published in scientific periodicals and became widespread. The laboratory was the only in the USSR in terms of specific character of the research, development and design work carried out by its specialists; it was rather famous, too.

Purely Russian idea

Professor Chostkovsky has been working on automation of all types of cable manufacture (including optic cables) since 1971. The organization called 'Special design bureau of cable industry' in Mytishchi was his main client for many years.

"Our team was carrying out all types of research, design and testing work there since 1980's until the government ran out of money for defense industry," the Professor says. "During 'perestroyka' the automated optic fiber drawing tower was

shown to Germans. In 1990's German physicist **Gerd Steineke** became interested in our methods of optic fiber manufacture automation and he invited me to work with him at a London company at a crossroads of High Street and Church Road. There we developed some methods that are still used in the manufacture of fiber optic cable all around the world. We worked with a 125 micron fiber that was able to transmit, for example, 10,000 phone conversations simultaneously!"

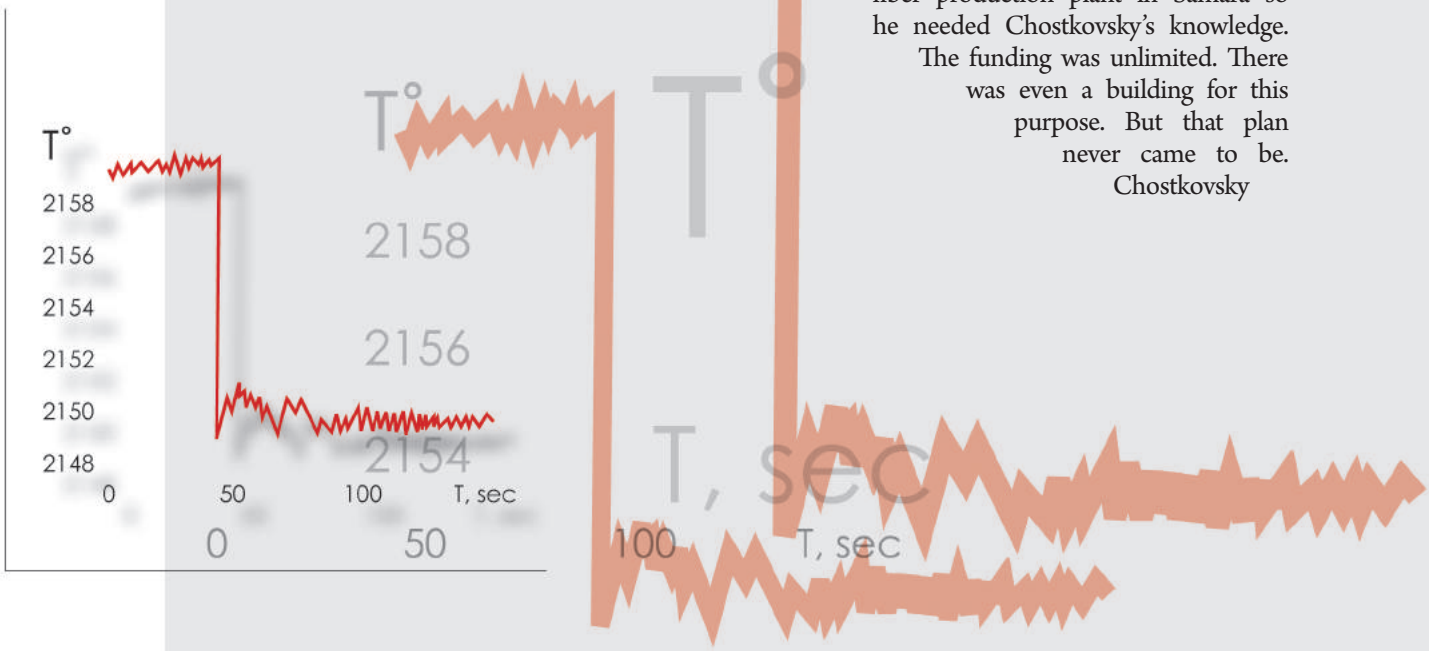
One of Professor Chostkovsky's inventions is a contactless sensor for measuring the fiber tension in the tower. The scientist says that two main things in automation are a sensor and a tension control system. In the early days, a contact sensor – a spring-loaded wheel that touched the fiber – was used to measure fiber tension. Tension was measured by wheel deviation. But it damaged the fiber. That's why a section of fiber was cut out and thrown away after measuring. Chostkovsky's contactless sensor measures tension continuously without damaging the fiber. It utilizes nitrogen jet. As the fiber is drawn, a jet of nitrogen blows on it. The method is simple and brilliant: the stronger the tension of fiber is, the less it is deviated by the jet. Automatic devices get the data and calculate it using Chostkovsky's formula for indirect measurement of fiber drawing tension. "Only Russians could come up with something like that!" said the foreign colleagues after they had examined Chostkovsky's technical idea, and American company 'CorningInc.', an absolute world leader of optic fiber manufacture, even sent him a fax saying that his 'know-how' was 'quite good'. Before the contactless sensor was invented, 40 per cent of manufactured optic fiber was rejected; after it was implemented, that amount was reduced to 10 per cent. Tension sensors used by 'CorningInc.' and 'Nokia' are of impact pneumatic action which is not quite good in terms of quality of finished product.

Dangerous plans

Very few people know that during 'perestroyka' Samara region could have its own plant for production of world-class optic fiber. But the plan of **Boris Skvortsov**, who was the head of regional telecommunication office back in those days, never came true.

In 1992 when the professor had just came back from another trip to London he was called by Skvortsov. Skvortsov insistently asked him for meeting. When Chostkovsky came to his study, there were some businessmen there and Skvortsov told him that he was going to launch an optic fiber production plant in Samara so he needed Chostkovsky's knowledge. The funding was unlimited. There was even a building for this purpose. But that plan never came to be. Chostkovsky had car accident on a highway; as he stayed in resuscitation department, all work was suspended for a long time.

Boris Chostkovsky thought it was an accident. But is German partner Steineke immediately suspected that there was evil intent there; he urged Chostkovsky to move to Germany. The indefatigable German scientists made plans to develop optic fiber manufacture all around the world. He even arranged Chostkovsky a meeting with an Arabic sheikh who was rather interested in their projects. Chostkovsky was still not certain if it had been an accident or an attempt to kill him when Steineke's secretary called him. She said that Gerd had suddenly died during intermediate flight stop on his home from Paris. "But he was a healthy man," Boris Chostkovsky lifts his hands in dismay. The same year the American company 'CorningInc.' rented a shop at 'Samara Cable Company'



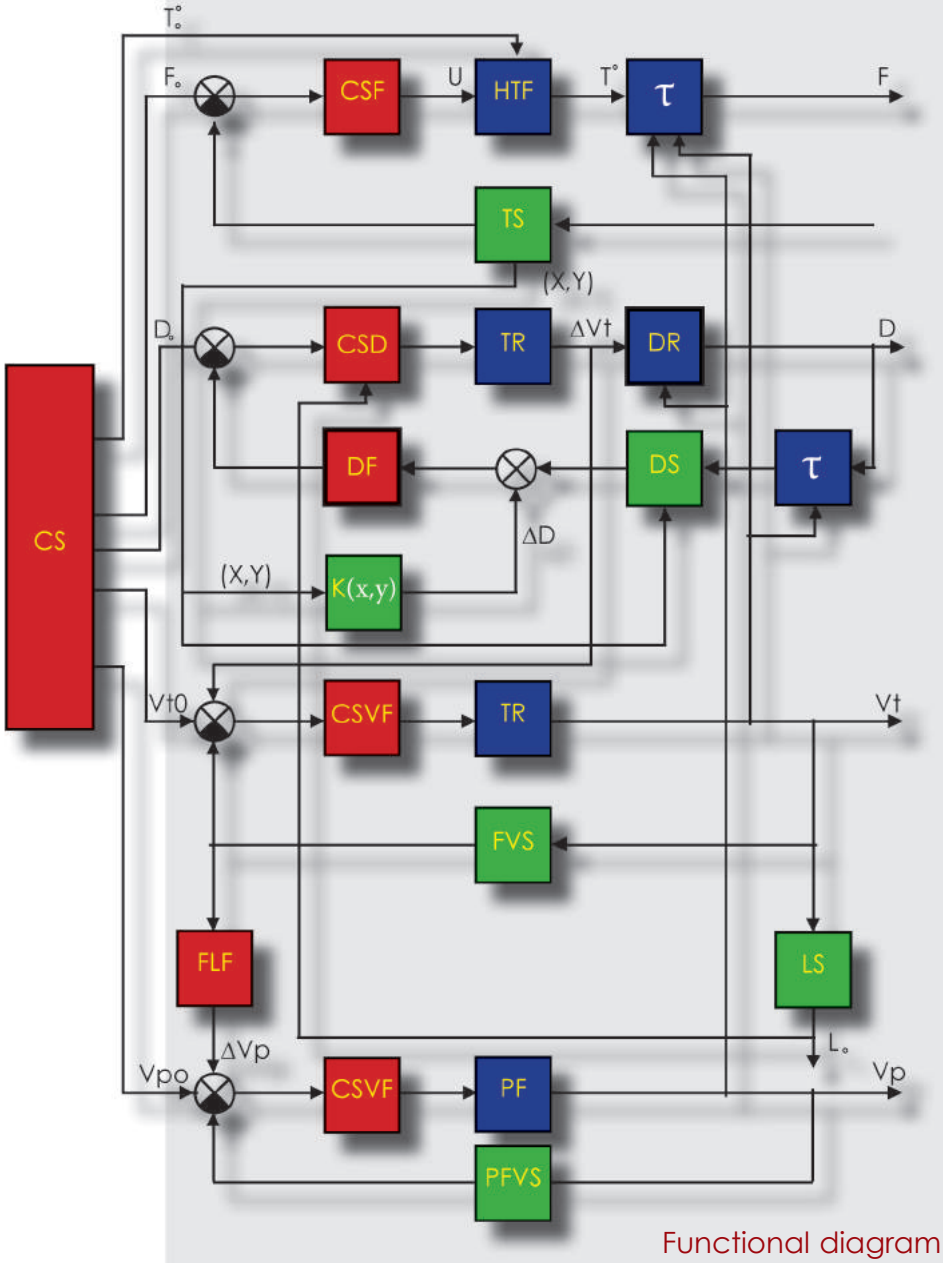
and started to manufacture optic cables using optic fiber from the USA. "As Steineke is dead, they don't have this major competitor who organized optic fiber manufacture in New Delhi, India," the Professor adds.

Political will

It's not enough to build a plant to reach success in manufacturing area. Its automated systems are also to be adjusted. That is where the personal qualities of a man who does this job are very important. Illustrative example is launch of a plant in New Dalhi carried out by Gerd Steineke. The plant was built and began to function. Steineke persistently asked Chostkovsky to come to India and help him to bring the production to designated level. Optic fiber drawing speed already was 600 m per minute but designated value was 1000 m. Chostkovsky couldn't come: the Indian climate would negatively affect the scientist's health. As a result, Steineke failed to bring the production to required level, and lost his investments; moreover, he had to pay a big penalty.

Today American companies are kings of the world optic fiber manufacture

Boris CHOSTKOVSKY, Doctor of Technical Sciences, Professor at the Chair of Automation and Control in Technical Systems. He was born on the 7th of June 1948. In 1971 he graduated from Kuibyshev Polytechnical Institute (SSTU) magna cum laude as a specialist in area of automation and telemechanics. In 1978 Chostkovsky defended candidate dissertation 'Technical cybernetics and theory of information'. In 2007 he defended doctorate dissertation 'Automation and control of technological processes and manufactures'. Boris Chostkovsky has 85 scientific papers including 23 patent certificates (among them are one British patent and two international patent applications published in compliance with the Paten Cooperation Agreement). He wrote a monograph and a tutorial recommended for all universities of Russia. Boris Chostkovsky is honored with the title 'The USSR inventor'.



Functional diagram of controlled optic fiber drawing system

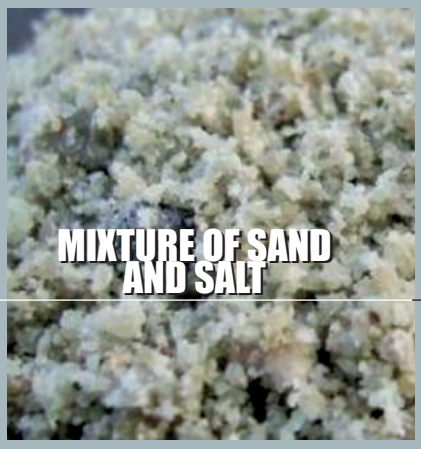
market. They have so many patents and reserved rights that sometimes it seems like it's impossible to enter this market. Chostkovsky says that even though the key specialist in MCVD technology of optical workpieces (preforms) manufacture, one of few people who knows exactly how to draw every single perform to get the designated optical parameters of finished optic fiber, Doctor of Chemical Sciences **Manfred Wittman**, is German, Germany doesn't manufacture optic fiber on an industrial scale. All manufacturing rights were bought by Americans. But Chostkovsky is sure: if there's political will, Russia will manufacture optic fiber with low attenuation rate. But only if the specialists of the Chair of Automation and Control in Technical Systems are engaged. And if there some problems that require some help from without, Boris Chostkovsky can always call his friend Manfred Wittman who will be glad to visit his colleague at SSTU as he did before, and lend his assistance.

Vladimir ANDREEV, Doctor of Technical Sciences, President of Povolzhsky State University of Telecommunications and Informatics:

"I met Boris Chostkovsky at a cable and communication plant in 1974. The plant set up production of new products and signed contracts both with Polytechnic Institute and us. At that time the issue of enhancing the quality of cables in terms of manufacturing process automation was really vital. That very job was done by Professor Chostkovsky. What he did was undoubtedly good for cable industry of our country: we needed automated systems very much; foreign equivalents were expensive and not widespread. The Polytechnic Institute, the Chair of Automation and Professor Chostkovsky did their best to help the plant begin manufacture of new communication cables."

ICE-MELTING CHEMICALS

Low price, combined effect (salt makes the ice melt, sand increases tire-to-surface friction), easy to use, explosion safety, non-toxic, effective at low temperature.



Makes the treated area dirty, aggressive to shoes.

Affordable price, easy to transport, effective at low temperatures.

Negative effect on soil and plants, causes corrosion of city drainage system and automotive transport.

Low consumption, non-hazardous for soil and plants

Allergenic, aggressive to skin and leather, reduces tire-to-surface friction coefficient.

Environmentally friendly

Expensive, negative effect on road surface, increased dust formation.

CHLORIDE, SALTPETER AND ICE CRUST

Scientists from Samara State Technical University have been successfully developing ice-melting chemicals

By Svetlana EREMENKO

Every winter the use of ice-melting chemicals causes sticky slush on the roads of Samara. Granulate dispersed by special-purpose vehicles rattles against cars; moreover, these chemicals destroy paint on automobiles and pedestrians' leather shoes.

Bad good stuff

Story of fight against ice on roads of the region started a long time ago. At first the mixture of sand and salt was used. But sand tended to clog the city drain system so it was decided to use salt only.

Three years ago road service of Samara started to use new ice melter; magnesium industrial waste is utilized to produce it. Manufacturers say that this ice melter can even fertilize the ground as it contains biophile elements.

"I doubt that," says Professor **Ivan Garkushin**, head of the Chair of General and Inorganic Chemistry. "Every ice-melting mixture consists of various elements; some of them are good for grass and trees and others are not. I think that absolutely non-toxic ice melters don't exist. So

chemists must develop ice melters that cause minimum damage to roads, vehicles and environment."

Ice-melters by SSTU

Thirteen years ago specialist of the Chair under the guidance of Professor Garkushin developed several types of liquid ice melters for city roads and highways at the request of Samara road service. Some of those melters were based on products manufactured in Samara region.

Our chemists had three options: develop solid salt-based mixtures, experiment with solutions that destroy the structure of ice or create liquid ice-melting chemicals. The latter option seemed the simplest in terms of putting the melter on the road surface.

The chemist used more than 20 chemical elements and compounds during the experiments with temperature of melting, dissolving and destruction of ice. Some months later they were ready to give the road service several types of liquid ice melter to be used at any temperature.

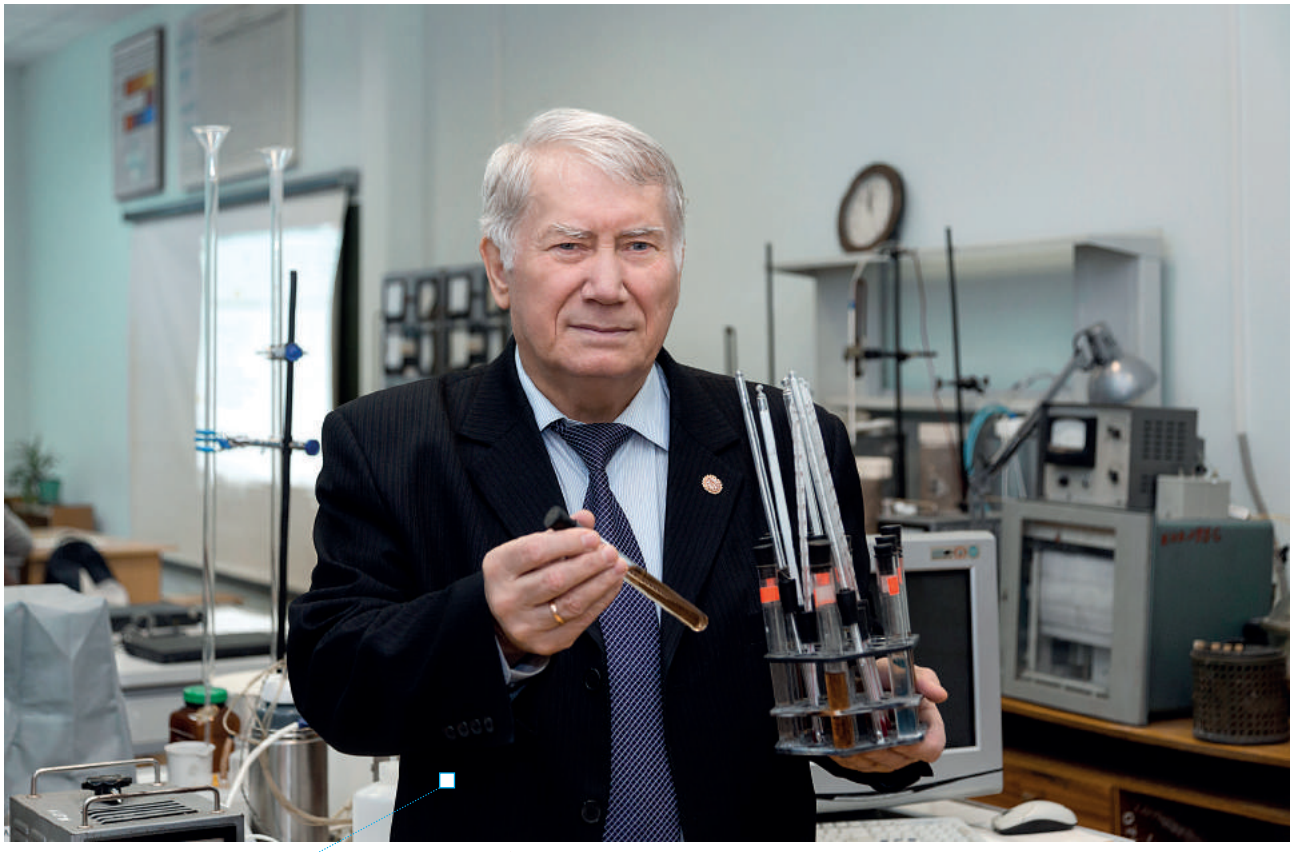
"All those melters were as good as other chemicals used at that time; some of them were even better," Garkushin explains. "For example, for city roads we developed a mixture of urea, ammonium nitrate and water. These basic components are actually fertilizers and do no harm to the environment and the melter itself could relatively fast melt the ice crust up to 5 mm thick."

Environmentalists would probably like this mixture. But unfortunately this melter has never been examined by environmental tests.

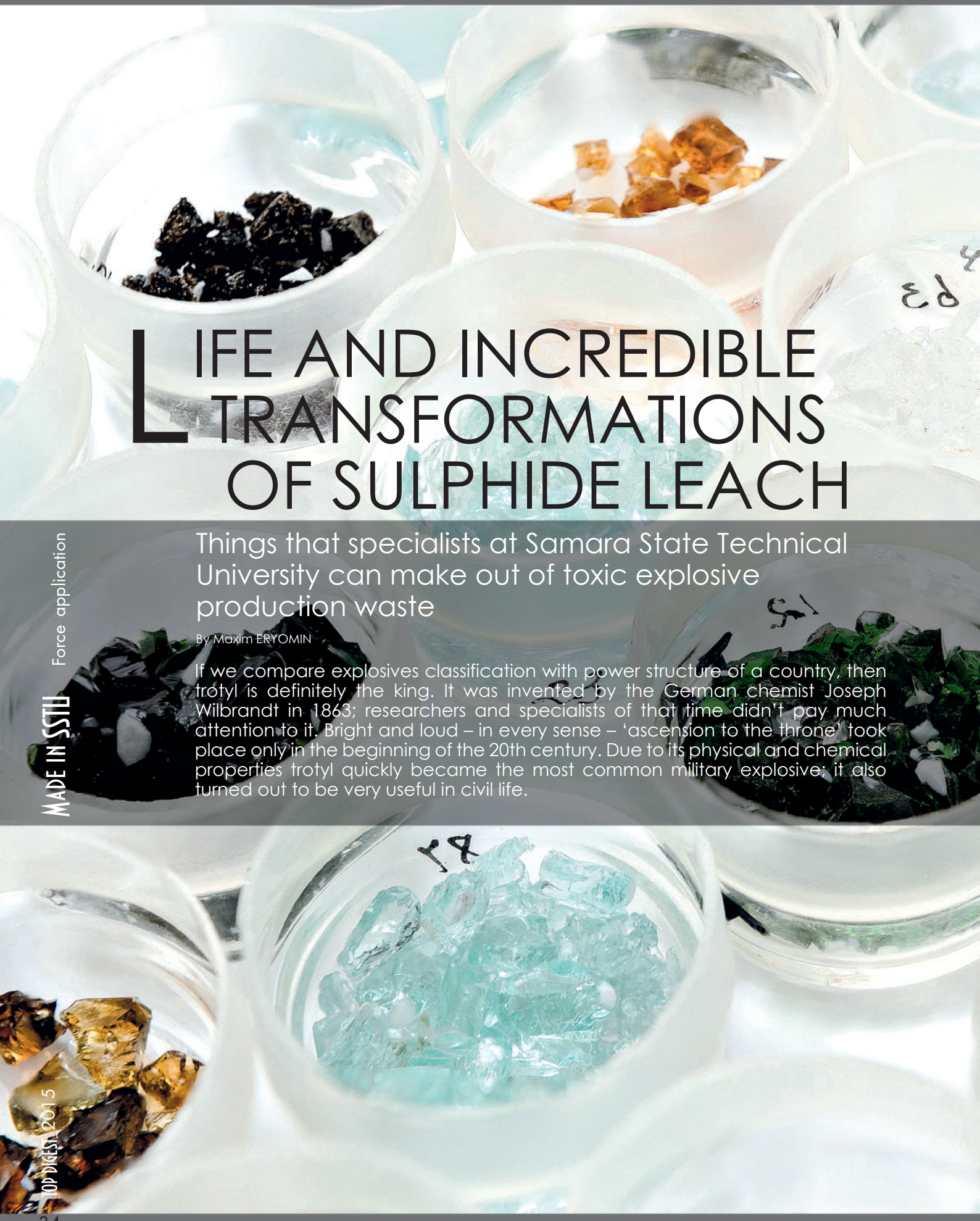
Meanwhile the SSTU specialists came up with another mix based on sodium chloride, calcium chloride and corrosion inhibitor. Road service successfully tested that melter at one the lakes in Krasnoyarsky region. That ice melter was manufactured in Chapaevsk and it was used to remove ice crust from Komsomolskaya square.

But some time later the machine that produced that ice melter broke down. The SSTU-developed melter was replaced by imported granulate 'Bionord'.

Today 300kg of this melter is required to treat 1 km of road surface. Some suspect that Samara-made ice melter is as good as chemicals produced in other regions but much cheaper.



Solid ice melter acts the following way. As the melter gets on the ice surface it starts to absorb water. Conversion from solid into liquid produces heat which is used to melt the snow. The resulting solution which consists of molten snow, ice and melter has lower freezing point temperature than water. It melts the ice and prevents it from further formation. Melter which melts as much snow and ice as possible at the lowest possible temperature with minimum effect on the environment is considered the best.



LIFE AND INCREDIBLE TRANSFORMATIONS OF SULPHIDE LEACH

Things that specialists at Samara State Technical University can make out of toxic explosive production waste

By Maxim ERYOMIN

If we compare explosives classification with power structure of a country, then trotyl is definitely the king. It was invented by the German chemist Joseph Wilbrandt in 1863; researchers and specialists of that time didn't pay much attention to it. Bright and loud – in every sense – 'ascension to the throne' took place only in the beginning of the 20th century. Due to its physical and chemical properties trotyl quickly became the most common military explosive; it also turned out to be very useful in civil life.

Enormous amount of trotyl was produced in the previous century. Open information sources say that 2.5 million tons of TNT was used during World War I. In victorious 1945 the USA alone produced more that 1 million tons of trotyl. Annual production volumes after the war reached the point of 40 thousand tons of this explosive.

Today trotyl is produced in considerably smaller amounts. Yet it is still used for military and civil purposes. Trotyl is very valuable for one of its properties – it retains its explosive potential over a long storage period. TNT produced in 1915 is still able to produce a powerful explosion as if it was manufactured only yesterday.

Leach

Every explosion is beautiful in its own deadly way – people got so carried away by trotyl that they nearly forgot about how insidious it was. Year after year sulfide lye produced in trotyl explosions gradually poisons the life on Earth. Each ton of this watery solution consisting of various nitro compounds and inorganic sodium salts contains up to 80-90 kg of toxic substance. We can only guess what harm had been caused to the environment while the military industry was increasing production rate and waving aside the problem of waste recycling.

The city of Chapaevsk, Samara region - its territory got literally leached: the city has been producing trotyl for more than one hundred years. Until 1953 liquid toxic wastes were drained off to the river. Old residents remember that people's hair used to get red after bathing in local rivers and small lakes.

When damage to the environment caused by trotyl production became too obvious, it was decided to change the waste recycling method. Wastes were recycled by vaporization and combustion. This method resulted in solid ash – up to 10 per cent of explosive produced. Today there are huge piles of ash at Chapaevsk's production waste sites. The same 'sights' can be found in several Russian cities as well. When it rains, water and ash form toxic drains that contaminate ground water.

Unusual usual glass

There are multicolored pieces of glass on the table – blue, green and orange crystals. **Alexander Pyzhov**, associate Professor at the Chair of Chemistry and Technology of Organic Nitrogen Compounds of SSTU, says that up to 40 per cent of trotyl production waste can be put into furnace charge (mix of basic components).

"We mix mother solutions and ashes of trotyl and nitrobenzene with earth silicon, chalk, dolomite

◄ Lead-containing waste of lead azide production.

◄ Sulfate-containing ash is waste of trotyl production.

◄ Lead-containing waste of lead styphnate production.

◄ Ash of nitrobenzene mother solution.

and kaolin and then melt he whole mix at the temperature of 1350-1400 degrees centigrade," the scientist explains. "Thus we get colored or non-colored glass which can be used for industrial and artistic production."

The mix, invented and patented by Alexander Pyzhov and his colleagues in 2014, has several advantages over mixes commonly used in glass production – lower melting temperature and relatively low cost of components. But the most valuable aspect of the SSTU invention is its environmental effect: toxic explosive production waste is turned into non-hazardous glass so there's no need to be worried about its recycling. The scientists developed optimal methods to produce silicate glass, soluble glass, packing glass, lead crystal glass, foam glass, as well as claydite and plaster. Moreover, these methods allow the recycling of all components of trotyl production waste and manufacture high-quality silicate materials.

Akmaral DJAHYAZNOVA, a fourth-year student of the Engineering-Technological Department of SSTU:

"There's no need for special production facilities to implement our method of brick manufacture. Our method is developed for existing equipment at brick-producing plants all around Russia. Besides lowering the cost of constructional material manufacture we also solve the problem of effective recycling of sulphide leach and environmental protection."

We also make bricks

Alexander Pyzhov shows a brick:

"Production of this sample costs much less than that of a traditionally-produced brick because 30-40 per cent of its weight is trotyl production waste."

Technology of silicate prick production hasn't changed much since Doctor **Michaelis** came up with the idea of treating bricks with hot steam under high pressure in the beginning of 19th century. The most common constructional material in the world still consists of filler and cementing medium. The filler is quartz sand, cementing medium is hydrated calcium silicates.

The SSTU scientists decided to replace cementing medium with sodium silicate which is produced by the reaction of sulphide leach to sand during the process of preparing, forming and firing of bricks at a temperature of 1000-1100 degrees centigrade.

Victoria Pirogova is a fourth-year student of the Engineering-Technological Department at SSTU; under Pyzhov's guidance she researches the problem of recycling lead azid production waste:

Samples of silicate packing glass and lead crystal glass. ►

"Lead crystal glass can serve as cementing medium as well. It is made of lead-containing carbonate waste; each ton of lead acid contains 100-150 kg of this substance. In order to produce a non-toxic ceramic brick we just need to mix glass furnace charge with sand, form and fire it."

Experimental data shows that the SSTU-developed bricks are more reliable than some modern constructional materials. Anyway, they are more moisture-resistant than silicate bricks and can be compared with red clay bricks in terms of their physical properties.

Future in the present

Specialists at the Chair of Chemistry and Technology of Organic Nitrogen Compounds of SSTU have been working on problems of recycling the explosive production waste for more than 25 years. There has been a noticeable breakthrough in this area recently. The scientist have already patented 12 new methods of trotyl production waste and collected materials for 5 more patents. Method of soluble glass production developed by Alexander Pyzhov and his colleagues n 2009 was included into the list of 100 best inventions of Russia.

Students are still interested in this problem as well; their ideas set out in their graduation works can, in the experts' opinion, become a basis for serious scientific research.

They will be able to turn a production waste site with tons of ash from zone of ecological disaster into real Klondike and turn non-waste trotyl production from dream to reality.

The environment is negatively affected not only by trotyl production waste but also trinitrotoluene itself. During the explosion part of active material disperses in the air; as it goes to the ground it contaminates the soil. Some plants absorb it and soon die because trotyl is very toxic.

KEYS TO TOMORROW

Results of breakthrough SSTU research will soon become a part of everyday life

By Maxim ERYOMIN, Svetlana EREMENKO

In 10-20 years the world will change. This truism is the basis of modern science and non-science fiction. Automobiles that look like a spaceship, post-high-tech style buildings, sweet and highly technological attributes of everyday life from 'smart' glasses to light bulbs that don't require an external source of power. Even not very highly imaginative people are able to envisage what the near future will look like. Scientists at SSTU are ready to implement some ideas that will soon change the way of our life.

THERMAL BATTERY

DEVELOPED BY:
Dmitry Pashenko, Candidate of Technical Sciences, associate Professor at the Chair of Industrial Heat Power Engineering; Anatoly Shyolokov, Doctor of Technical Sciences, head of the Chair of Chair of Industrial Heat Power Engineering

APPLICATION AREA:
industry, transport, housing and utility sector, households

ESTIMATED TIME OF MASS PRODUCTION:
2020 – 2025

Today

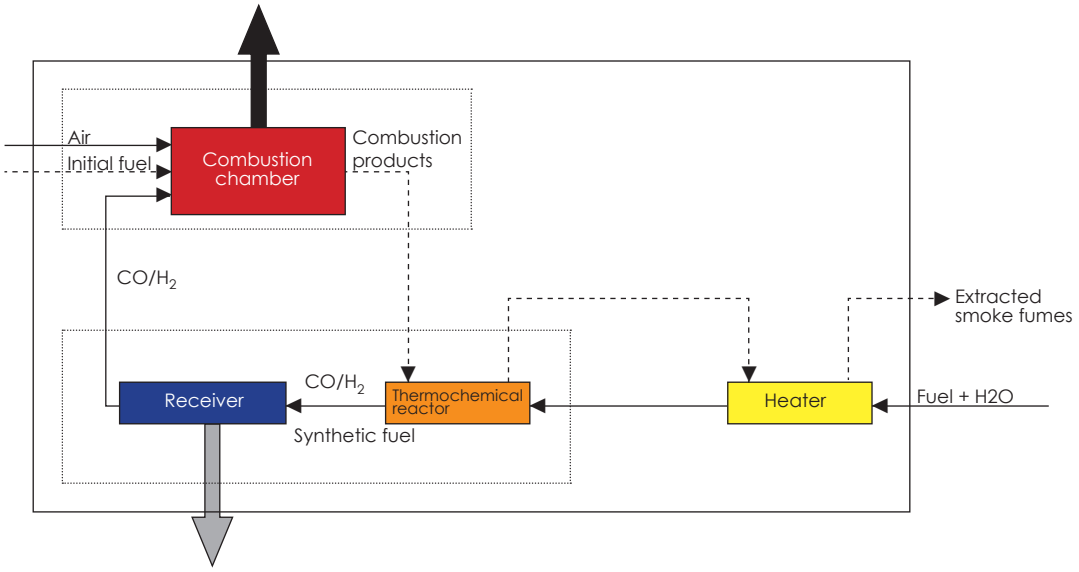
A thermochemical accumulator of heat power is pretty much the same as an electric battery. The operating principle of this device – still too big to be used at home – is very simple. It is based on using the materials left after fuel combustion. They turned out to be useful in terms of energy production.

So, after the combustion products leave combustion chamber they are not thrown away to contaminate the environment but fed into the thermochemical reactor. Preliminarily heated initial components – organic fuel (natural gas, diesel or ethanol) and water vapor – are fed there as well. As the result of endothermic

Dmitry Pashenko:

"Now the prototype of our accumulator is functioning on the 'Kuznetsov' joint stock company. The idea of using it for boilers seems to be the most realizable for the time being. This device has rather high coefficient of efficiency. But fluctuations of average daily temperature make it 'bounce' as well. With full design load the coefficient of efficiency is up to 95-97 per cent; if design load goes down, coefficient is up to one-third lower. Heat accumulator can fix this situation, i.e. convert part of heat into chemical energy when load is not full and use this energy instead of combusting organic fuel when load is full. Thus we enhance reliability of equipment, reduce energy consumption and increase power efficiency."

In general, this accumulator can be used in many areas. For example, in cars: when engine is overloaded, certain temperature of fuel combustion is reached and heat is accumulated; at the next stage energy can be partially provided not by fuel but accumulator. Or in aircrafts: when plane goes on high speed its cover gets hot because of friction against air. The above mentioned thermochemical reaction can be also be used to remove this heat.



reaction, synthetic fuel is produced – mixture of hydrogen and carbon monoxide. This gas is collected in receiver and then used as fuel.

Thus, by transforming physical heat into chemical energy we get the 'postponed action' heat source. Imagine that we have some redundant heat due to operation of engine or boiler. According to the described principle this heat is transformed into hydrogen and carbon monoxide; it can be burnt in the same engine or boiler in 24 hours, a week or a year – this device can relatively easy accumulate energy and save it for a long period of time. This feature makes the thermochemical accumulator advantageous as compared with exiting heat accumulators; moreover, these accumulators are made of highly heat resistant material which makes the entire device unreasonably expensive.

Tomorrow

The operating principle of this thermochemical reactor can dramatically change the vision of energy saving and make alternative energy the most useful power source in a household for example. Several devices like this at home with roof and walls constantly heated by sun will allow the collection of redundant heat and use it for heating in winter.

NON-EXPENDABLE FUSE

DEVELOPED BY:
Alexander Voronin, Candidate of technical sciences, associate Professor at the Chair of Power Plants of SSTU; Nikolay Ivanov, SSTU undergraduate; Alexander Kazantsev, postgraduate at the Chair of Automated Electrical Power Systems of SSTU

APPLICATION AREA:
electrical power engineering, electrical technology

ESTIMATED TIME OF MASS PRODUCTION:
2020 – 2021

Today

Modern people depend on electrical power as much as cavemen depended on sunlight or fire. Electricity provides us with light and heat, it powers our washing machines, vacuum cleaners and phones, it broadcasts football matches, movies and news reports, it sends our e-mails and prints documents – in a word, it creates the environment that we commonly call civilization.

Rapidly growing electric power consumption severely stresses electricity networks. Increased electrodynamic and thermals forces shorten operation life of equipment, increases the probability of its damage and reduces the overall reliability of power supply system. Equipment at some areas of network is going to be replaced, it doesn't meet new requirements set by newly adopted values of short circuit current.

In order to minimize the scale of accidents and grave consequences, additional safety devices are used; they limit network overload. Use of expensive and bulky current-limiting reactors requires technical and economical substantiation. Moreover, this way to solve the problem is in not acceptable for power engineering specialists anymore as it has become too obsolete.

Cheap and small fuses are not perfect too as they are disposable. It means that in case of a short a fusible copper or aluminum wire melts and breaks thus stopping the current from going through the circuit. Equipment will stand idle until fuses are replaced.

The SSTU scientists are developing a brand-new non-expendable fuse. It has become possible due to new technology based on liquid metal – eutectic alloy of gallium (67 per cent), indium (20,5 per cent) and tin (12,5 per cent). This silver-colored alloy stays liquid within temperature range from 10,5 to 2000 degrees centigrade. Operating principle of this device is the following: when temperature raises, liquid metal inside turns into vapor and breaks the circuit; than it cools down and

condenses thus closing the circuit again. The specialists say that this technology reduces the size of the fuse and lowers its price.

Tomorrow

Practically all industrial enterprises producing electrical equipment can become key partners of this project. In Samara region alone companies like Schneider Electric, Electroshield, Samara Transformer and Togliatti Transformer can support young scientists from SSTU. Electroshield is already interested in this invention. Technical manager of Samara Network Company (SNC) Andrey Kazantsev said that the company was very much interested in that innovative technology as existing current limiting devices had some disadvantages. SNC promised to provide a site for operation tests, Moscow United Electrical Network Company is about to provide tutorial support to the developers. By experts' estimate, the potential market for this device is enormous. These fuses can be used at transformer substations 6-10/0.4 kV (there are more than 300 thousand such substations in Russia and more than 6 million in the world), power plants (516 in Russia, 11,000 in the world) and large and medium industrial enterprises (22,000 in Russia, 600,000 in the world). According to 2014 data, Russian electrical equipment market is estimated to be 1.8 trillion rubles. Safety devices share is 180 million rubles.

Nikolay Ivanov:

"As amount of produced and consumed electricity increases, electrical power overcurrent in network inceases too. As a result, the equipment installed 10, 20, 30 years ago is exposed to increased overloads that are beyond its design. It leads to increase wear and breakdown probability. Our device can solve this problem. Advantages of non-expendable fuse are high response speed, automatic restoring, small size and no energy losses during nominal mode of operation. At the present moment the project has already shifted from idea to research and development. Small-scale prototypes were successfully tested in our laboratories and positive results we got show that this device is functional."

CURE FOR EPILEPSY

DEVELOPED BY:

Yuri Klimochkin, Doctor of chemical sciences, head of the Chair of Organic Chemistry at SSTU; Alexander Reznikov, Candidate of chemical sciences, associate Professor of the Chair of Organic Chemistry; Marina Leonova, Candidate of chemical sciences, associate Professor of the Chair of Organic Chemistry; Nadezhda Belaya, postgraduate, scientific associate at the Chair of Organic Chemistry; Anastasia Sibiryakova, engineer at the Chair of Organic Chemistry;

APPLICATION AREA:

pharmaceutical chemistry, medicine

ESTIMATED TIME OF MASS PRODUCTION:

2019 – 2020

Today

Epilepsy is considered to be the most common neurological disease in the world. By experts' estimate, 50 people out of each 100,000 get this disease every year in developed countries. More than 500,000 people in Russia suffer from this disease and this number increases every year.

Effective medicines to treat epilepsy are pregabalin-based medicines. They also help to ease neuropathic pain.

From chemical point of view pregabalin is (S)-3-(aminomethyl)-5-methylheanoic acid, or C8H17NO2. It's not very easy to synthesize this compound. A key aspect in its multi-stage synthesis is the use of catalyst. Expensive platinum-based reagents are used for production of the most commonly used anti-epilepsy medicine called "Lyrica". This leads to a high price

Japanese nuclear magnetic resonance spectrometer allows the SSTU chemists to get wide definition spectra to elucidate the structure of organic compounds. It is the only spectrometer of such kind in Samara region. ▼

of the medicine – a package of 56 pills costs about 4000 rubles in Russia.

Scientists at SSTU developed a new technology to synthesize pregabalin without platinum. Platinum is replaced by nickel which is significantly cheaper.

Before obtaining pregabalin, our chemists synthesize so-called chiral ligand which is a part of catalyst. SSTU scientists are developing various types of ligands that form chemical compound with nickel. The basic compound for this process is aziridine (this substance is also able to withstand influenza virus: it blocks ion ductuli of virus thus stopping the process of reproduction).

Nadezhda Belaya:

"The main disadvantage of existing technologies for synthesis of this vital drug is the high cost of reagents. Our goal is to simplify synthesis of active substance which is pregabalin. Of course there's much work to do to study physical and chemical properties of chiral ligands obtained and test the repeatability of our technology. Moreover, pharmaceutists must work out the formula and test its bioequivalence. And yet we are going to make a medicine that will be superior to its foreign equivalents in terms of quality and which will be able to win no less than 20 per cent of Russian market of anti-epilepsy drugs."

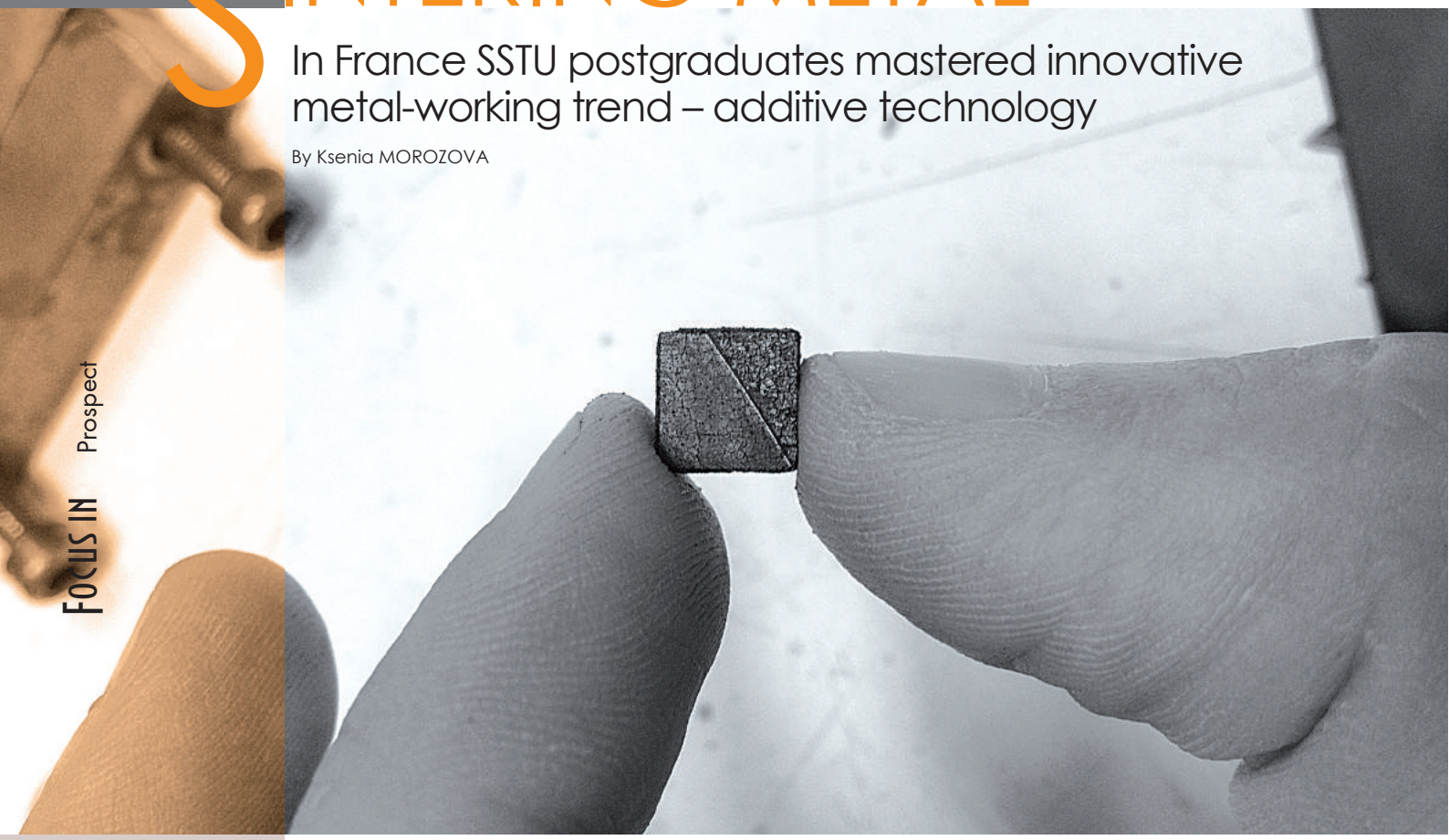
Tomorrow

Today the exclusive license to 'Lyrica/ pregabalin' belongs to the American pharmaceutical company 'Pfizer'. But on the 30th of October 2018 this license will expire. That when the technology for synthesis of generic form of pregabaline developed by chemists from SSTU can come in handy. (Generic is cheap equivalent of a drug with expired patent protection. Basic components of generic drug are completely the same as the original drug). Yearly growing demand for this medicine, relatively low production cost and retail price may become a guarantee of successful import replacement in this area of pharmacy.

SINTERING METAL

In France SSTU postgraduates mastered innovative metal-working trend – additive technology

By Ksenia MOROZOVA



SSTU graduates Konstantin Churikov and Vasily Lyubakha won the French Government grant for course of training in National Engineering School of Saint-Etienne (ENISE).

They took a 10-months training in Mechanical Engineering, subject of Surface and Interface Science and Engineering. Konstantin and Vasily had to master a completely unfamiliar to them method of metal-working – selective laser melting. By the way, this technology is rather rarely used in Russia.

We will print it by metal

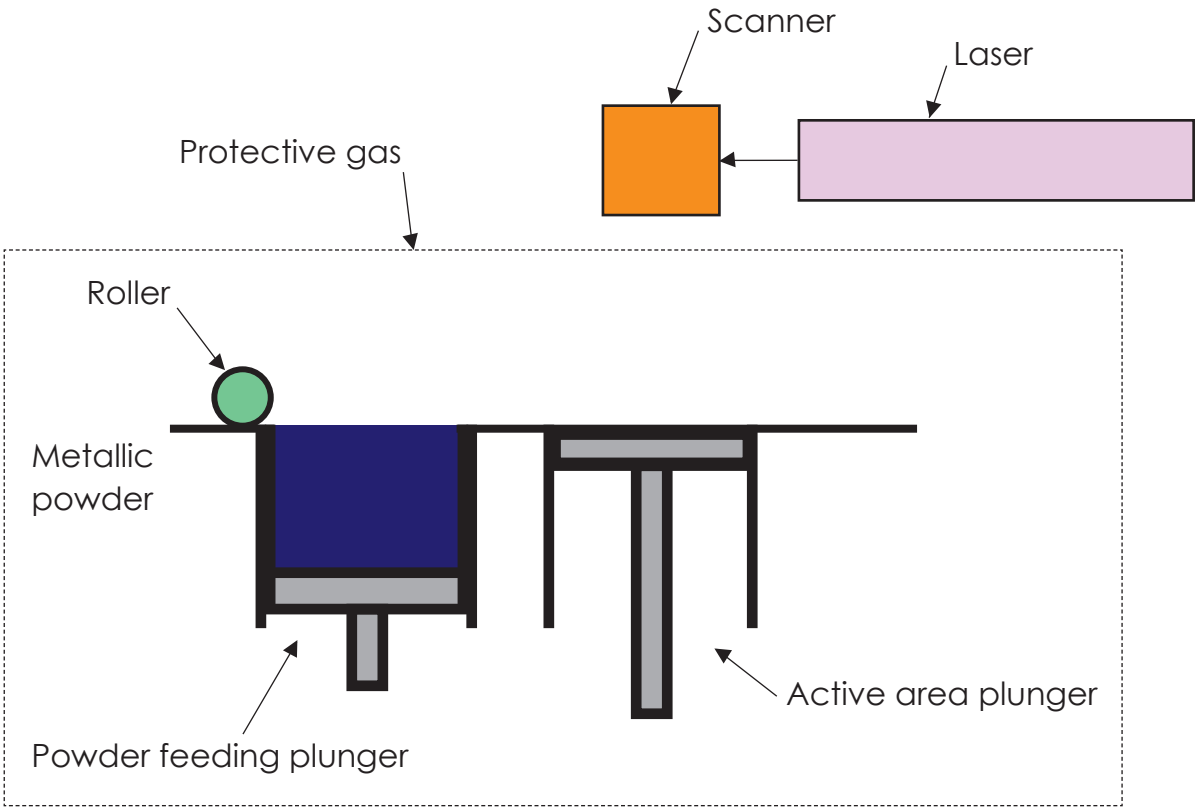
Selective laser melting or sintering is one of 3d print methods; it's layer-wise melting of metallic powder by laser beam. This technology is basically used in aircraft building, power engineering, machine-building medicine; it allows the creation not only 3d prototype models but also fully functional end products.

The method works in the following way: a powerful laser scans the surface of metallic powder, compares it step-by-step with preliminary 3d model of a future metallic part and then sinters the powder into desired 3d form.

Made their contribution

Final stage of training in Saint-Etienne was master's dissertation defense. Konstantin carried out research called 'Parametric research of selective laser melting of clad powders'; Vasily's work was titled 'Research of physical properties of 3d parts produced by selective laser melting of nickel-based super alloys'.

Many machine-building companies are interested in this technology as they manufacture parts that are too sophisticated to be produced using traditional metal-working methods.



Multifunctionality is one of the main advantages of this technology.

Firstly, this technology allows work with various types of powders: metallic (titanium alloys, steel etc.), polymeric (nylon, polystyrene) and ceramic. Using additive technology architects can 'print out' entire houses, and medics – prosthetic appliances and implants.

Secondly, there several modes of sintering process: full melting, liquid-phase sintering and partial melting.

Thirdly, special cooling system significantly shortens the time needed for production of a single part, enhances the efficiency and cuts production costs.

Fourthly, this technology allows the creation of both large objects and small parts so it can be used to create custom jewelry. Metallic 3d printing doesn't require additional processing equipment thus reducing the production cost of the end product and eliminating defects.

OUR SCIENTIFIC ACHIEVEMENTS AT SAINT-ETIENNE ENGINEERING SCHOOL

During parametric research of selective laser melting of clad powders Konstantin Churikov:

▸ EXAMINED

the behavior of these materials during various production processes (pressure molding, sintering treatment, cold spray, selective laser melting)

▸ COMPARED

the properties of clad powders WC-Cu and B4C (clad powder used for production of multifunctional 3d products or surfaces; its particle consists of two parts – ceramic core and metallic coating) and their compounds of identical composition obtained by mechanical mix of the powders and by preliminary alloying method

▸ EXPERIMENTED

with clad powder B4C-Co using the technology of selective laser melting. Three sets of experiments with different parameters (laser power, scanning speed, thickness of powder layer, distance between two tracks – 'hatch distance') and conditions (with / without preliminary heating of operating space) of processing were arranged

The LifcoIndustry company is particularly interested in this powder as it manufactures abrasive cutting tools: the specialists look at the ways of using the powder as coating for the tools to enhance their wear resistance.

Konstantin Churikov, graduate of the Machine-Building and Motor Transport Department of Samara State Technical University, engineer at Innovative Center of Technology Transfer:

"Experiments carried out in Saint-Etienne resulted in a 3d object with density of about 97 per cent, high hardness close to that of pure boron carbide (approx. 3700 Vickers) and macroscopic uniformity. This result is very successful if compared with research carried out in 2014 when density of obtained sample was only 60 per cent."

Vasily Lyubakha, graduate of the Machine-Building and Motor Transport Department of Samara State Technical University, engineer at Innovative Center of Technology Transfer:

"My work is a part of research carried out by AGATCO group which develops a micro-turbine for simultaneous production of electricity and heat energy. It should be 5-10 times more effective than the equivalents existing today. Parts of the turbine are designed to operate at temperature of about 1150 degrees centigrade. The only material able to provide proper operability of these parts in such conditions is heat-resistant nickel-based alloy, properties of which were analyzed in my research work."

During research of physical properties of 3d parts produced by selective laser melting of nickel-based super alloys Vasily Lyubakha:

▸ EXAMINED

the process of selective laser melting of Inconel 718 and Hastelloy HX (alloy of nickel, chromium, iron and molybdenum) – materials with decent mechanical properties that are resistant to high temperature, corrosion and cracking

▸ ANALYZED

the properties of samples obtained during selective laser melting with different parameters. Samples made of Inconel 718 were uniformly hard, had layered structure and porosity of less than 1 per cent. Experiments with Hastelloy HX resulted in samples with porosity of about 2 per cent

▸ DEVELOPED

flow sheet for defect-free manufacture of complex functional components made of nickel alloys using the technology of selective laser melting

'X' REACTIONS

SSTU scientists developed new methods of getting chemical compounds that the future of mankind depends on

By Lyubov SARANINA

The chemistry of heterocyclic compounds is like an open book for the Candidate of Chemical Sciences Dmitry Osipov. Simply put, heterocycle is a ring of atoms of carbon, nitrogen, sulphur or oxygen. Various cellular structures and most of drugs are based on such compounds. However, some of them are rather hard to synthesize and chemistry faces the challenge of finding cheaper and easier methods of obtaining them.

"We develop new, simpler methods of getting heterocyclic compounds," **Osipov** says. "But the most interesting point is that we create methods that have no equivalents so far. Imagine that there is a heterocycle but nobody knows how to synthesize it. We do and we offer this method to others."

Dmitry made his first steps in science when he was a second-year student. **Vitaly Osyanin**, associate Professor at the Chair of Organic Chemistry, supported the student's research. Together they began working on a subject with great potential. As a result of this cooperation, Osyanin defended a doctoral dissertation 'Synthesis of benzannulated heterocyclic systems on basis of cascaded transformations of ortomethylene quinones', and Osipov defended a candidate dissertation 'Reaction of ortomethylene quinones with ambyphile reagents in synthesis of annulated oxygen-containing heterocycles'.

Behind these titles there is long fundamental research; results have already proved its practical importance. Ortomethylene quinone is a short-lived particle which reacts with various reagents of reaction mixture at room temperature. By changing temperature mode of reaction or using specially selected catalysts Osipov uses ortomethylene quinones to synthesize heterocyclic structures with various properties that can be used in pharmaceutics. Substances created by the Samara scientist have an active effect, for example, on the first-type herpesvirus, as well as the 'A' influenza virus. Dmitry says that many of the compounds synthesized using the SSTU-developed methods also have antitumor effect. This means that pharmachemists have made another step toward a cancer cure.

At the present moment 'Vector' State Scientific Center of Virology and Biotechnology and Volgograd Medical

Dmitry OSIPOV, Candidate of Chemical Sciences, assistant lecturer at the Chair of Organic Chemistry of SSTU. He published more than 30 scientific works. Osipov won the popular scientific show ScienceSlam-Samara in 2014 and participated in the fifth German-Russian ScienceSlam on the 28th of June 2015 in Karlsruhe.

University have become interested in the ideas of Osipov and Osyanin. The Volgograd Medical University experts are going to test some compounds synthesized by the Samara scientists for ability to cure second-type diabetes.

In general, research for new methods of getting heterocyclic compounds with ortomethylene quinones has been carried out all around the world for many years. Not only Russian but also American and European chemists have been struggling with the problem of synthesizing brand-new competitive heterocycles with unique physical properties.

"We compete with China, USA and Germany," Osipov explains. "A very important thing in this situation is not to let other competitors take the initiative. For if everybody works on this problem, it means that it is really very serious."

As for ortomethylene quinones, the Samara scientists have no rivals in studying their properties. Their achievements are constantly presented on various conferences. Osipov has already participated in major scientific forums in Turkey and Netherlands. He says that foreign colleagues ask many questions which indicate that they are genuinely interested in this research subject. Osipov explains:

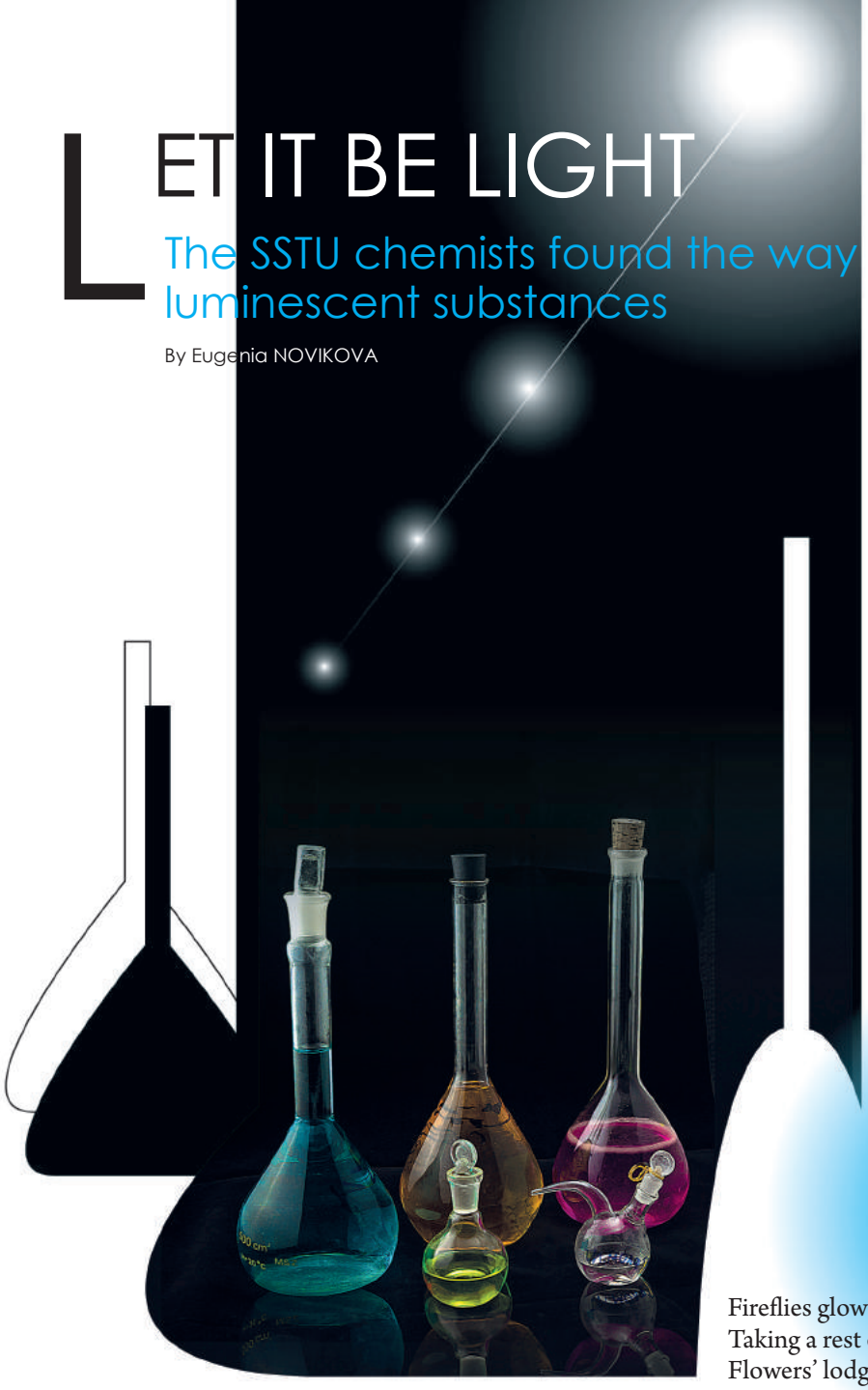
"Today our goal is to find some special physical properties – for example, fluorescence or conductivity – in the heterocycles we have synthesized. We haven't done much in this direction yet but I think that we will succeed."

Today our chemists have the record of two methods for synthesis of previously unknown active compounds, about 50 international-level articles that are frequently quoted in scientific periodicals.

LET IT BE LIGHT

The SSTU chemists found the way to utilize luminescent substances

By Eugenia NOVIKOVA



Fireflies glow so brightly
Taking a rest on branches of the tree!
Flowers' lodging for the night!

Organic luminophores are harmless substances that possess luminescent properties, i.e. they glow if illuminated by ultraviolet light or exposed to chemical, electrochemical or mechanical treatment. In many cases one and the same luminophor can be actuated by different types of energy (UV-rays, X-rays, friction, chemical reactions etc.). A lot of organic luminophors have been synthesized so far but scientists keep searching for new compounds possessing unique properties (thermo- and light stability, certain luminescence colors, chemical activity or inertness).

Author of this haiku, famous Japanese poet of the 17th century Matsuo Basyo, and assistant lecturer at the Chair of Organic Chemistry of SSTU, Candidate of chemical sciences **Violetta Meshkova** have two things in common. Both of them like oriental poetry and can learnedly talk about fireflies. But in contrast with the classical Japanese poet who admired natural beauty of glowing bugs, the young scientist at SSTU is interested in way more down-to-earth things.

'Lumos' without magic wand

One of the aspects of Violetta's scientific research is study of properties of organic luminophors. Over 2000 types of insects of the Lampyridae family have these substances in their luminous organs. It turned out that that glowing 'filling' of bugs can be used in power engineering,

medicine and industrial ecology. **Yuri Klimochkin**, head of the Chair of Organic Chemistry, and associated Professor **Alexander Yudashkin** guide the SSTU research in this area.

"I became interested in organic luminophor synthesis when I was a student," Meshkovaya says. "I think that this research has great prospects as these chemical compounds are rather widely used today. For example, luminophors are used in organic thin-film transistors, solar batteries, LEDs, various semiconductors and other modern devices."

Now Violetta is studying the relation between luminescent properties of substances and their molecular structure. The young scientist is particularly interested in the way of changing certain characteristics (e.g. conductivity parameters or glow efficiency) of these astonishing chemical compounds.

How to find metal

Since 2012 Meshkovaya has been heading the 'MAURIS' company; one of its co-founders is SSTU. This small enterprise works on methods of using luminophors as indicators for detecting ions of toxic metals in water or soil.

"Let us assume that some substance glows if illuminated; by adding ions of mercury or ions of lead we can change the intensity of glowing or completely stop it," Meshkovaya explains.

Preproduction series of indicators for detecting ions of metals in various media has already been completed. For example, they detect lead, mercury, chromium, nickel and iron. But large-scale production is still a long way off. Scientist require funding but in order to get it they must prove to a potential manufacturer that their technology is working. Now the specialists at 'MAURIS' work on optimization of methods for luminophor synthesis: they define photophysical parameters and improve the structure of synthesized substances.

"We have an idea of creating special indicator paper to put it to a medium and measure its parameters," Violetta tells us about their plans.

This paper will allow the carrying out of primary analysis of chemical composition of water or soil without using expensive stationary laboratory equipment, for even microquantity of luminophor is able to detect the presence of metals.

Healthy isomers

Scientists at the Chair of Organic Chemistry also work on catalysts for asymmetric synthesis reaction. These substances also possess luminescent properties and are used as reagents for ion analysis of metals and for production of intermediate products during preparation of drugs.

▲ Violetta Meshkovaya studies the luminescent properties of substances.

"There are substances that can exist as two optical isomers, one of which provides the therapeutical effect while another can cause a complication and other side effects," Violetta explains. "There was a medicine in the late 1950's; it caused no side effects so it was prescribed to pregnant women. Later it turned out that women who had taken that medicine gave birth to children with various congenital deformities. Investigation showed that the medicine contained two isomers: one of them was healthy and another led to grave consequences."

There are a lot of compounds that have several structural isomers, but only one isomer – with proved therapeutical effect – is used for drug preparation all around the world. Catalysts developed by the specialists at the Chair of Organic Chemistry allow the synthesis of that very healthy isomer.

Violetta Meshkovaya, Candidate of Chemical Sciences, assistant lecturer at the Chair of Organic Chemistry of SSTU. In 2010 she graduated from the Chemical-Technological Department of SSTU. While studying at the university, she won 28 various prizes for participation in scientific seminars, forums, congresses and academic competitions. She also won the first prize at the 'CLEVER FELLOW-2010' competition. Violetta is a member of SSTU council of young researchers and experts. She has the Cambridge FCE certificate confirming her knowledge of English. She studies Japanese and French.

THE MYSTERIES OF PARACONULARIA

A unique find of geologists from Samara State Technical University raised a number of questions for the scientific community.

By Tatiana VOROBYOVA

For two hours scientists and students from Samara and Tomsk were examining Baytugansk geological cropping in Kamyshlinsky District of Samara region investigating the diversity of brachiopods (a type of marine invertebrate animals). They were about to leave when Alyona Konovalova, a lecturer of Oil Technological faculty of Samara State Technical University, decided to take a couple of large plates as a visual aid. The geologist went down the mine and soon the members of the expedition heard her loud cry: "Why do the most interesting things happen in the last moments?"

The rare find

"Alyona pulled out a big plate and carefully put it into the car, "- said Natalia Likhopoenko, Konovalova's colleague. "We all stood in reverent silence staring at the unusual discovery. "

There are no paleontologists at Samara State Technical University but geologists of the expedition from Samara and Tomsk using special literature identified the fragments as Conularia, rare animals that lived on the territory of our region about 265 - 270 million years ago at the time of sea and transitional lagoon facies.

Paraconularia are the most rare representatives of Conularia. The fact that they were found near the village of New Baitugan was confirmed by Tomsk paleontologists, scientists of Belgorod University and a number of other specialists.

"Conularia are considered to be the organisms which are difficult to classify since the findings are rare, and the degree of preservation of the remains does not allow to draw any conclusions about their habitat and way of life. Some scientists consider them to be medusoid organisms that are reproduced by gemmation, other scientists suppose them to be included in a coral group", - said Alyona Konovalova.

It is the first time that our expedition has discovered "strange" Conularia in the Samara region, and the preservation of the skeletons is very good. Although deposits of this age occur in our region quite often, Conularia was found only in one section.

Questions and Contradictions

Now the scientists face serious scientific controversies about at least two questions concerning the accidental find.

Since earlier the researchers found only single species with discs for attaching to the bottom, it was believed that Conularia were singletons. The joint expedition from Samara State Technical University and Tomsk State University has found the remains of the five individuals that are in an unusual position: they seem to "grow" from a common center.

"Probably, these creatures lived on the sea floor being attached to some base", - suggested Alyona Konovalova.

A unique find in Baytuganskiy layers allowed to develop a hypothesis of the colonial pattern of animals.

Due to the well-preserved Paraconularia one additional debatable issue has arisen. On the skeleton of the phosphate composition the geologists of Samara State Technical University visually discovered a lamellar layer that is not characteristic for the jellyfish. This indicates that Paraconularia had a hard skeleton which is typical for clams. Ammonites, for example, have lamellar layers which are found in sections of the Cretaceous and Jurassic ages in the Samara region. Previous findings of Conularia didn't have lamellar layers, either because the remains had poor degree of preservation or they didn't exist initially.

Conularia (the class name Scyphozoa comes from the Greek word skyphos, denoting a kind of drinking cup and alluding to the cup shape of the organism, Conulat subclass comes from the Latin word conulus, denoting a «small cone") are extinct organisms with conical, cigar-shaped or pyramid-like skeleton. Typical sizes of Conulats are 3 - 5 cm. The thin flexible chitinous skeleton was impregnated with calcium phosphate. The color is from brown to grey. The outer surface of the skeleton as a rule had thin transverse ribs. Along the corners, and often on the edges of the pyramidal Conulat the longitudinal grooves are observed. Conical Conulats had similar grooves. Conulats were marine animals and led a plankton or bottom lifestyles.

▼ This petrified wood found by geologists grew thousands of years ago.

The scientists do not believe in words

The scientific community has learned about the unique discovery in May 2015 at the international scientific conference in Kazan. **Sergey Rodygin**, professor of Tomsk University made a presentation there. His co-author Alyona Konovalova commented on the effect of the rare find: "The scientists do not believe in words. A single discovery leads to caution just because it is single. One cannot draw a conclusion based on a single fact. Why wasn't Conularia found in this position anywhere else in the world? Perhaps, this find is an exception. Our assumptions are rather bold, and before we make any conclusions, it is necessary to conduct detailed and hard research work which will result in the systematization of our knowledge."

▲ In the expeditions students and lecturers of Samara State Technical University find valuable geological material. ►

Research will be conducted in Samara and in Tomsk. The primary task of geologists from Samara is cleaning of the outcrop, a refined describing of the geological section and layers (in the middle of the last century they were first described by the famous geologist Nikolai Forsch) and defining of the facies. Simply speaking, it is necessary to determine if Conularia lived in the open sea or in the lagoon and to define their neighboring species.

"We have already decided on the age of the layers and denied the initial assumption that Conularia were in the section of the deepest water layers," - said Alyona Konovalova. "We found out that depositional conditions were changing in the study period which is proved by the increase in volume of the clay material."

While studying the lamellar layer Samara scientists are planning to conduct X-ray and thermal analysis, as well as the microprobe analysis in the laboratory of the building № 7 of Samara State Technical University. The results will face new challenging issues.

Conularia unite

"We have to involve all professionals who can do something to help us. For example, we consulted Vladimir Morov, a specialist of the Institute of Ecology of Volga Basin RAS (Toglyatti), and Vladimir Efimov, Director of Undory Paleontological Museum. In autumn we are going to examine the open-cut with scientists from Tomsk again. Conularia united us because this scientific problem cannot be solved in isolation,"- said Alyona Konovalova.

The results allow to set the record straight but it is already clear that the scientific value of the natural artifact is undisputable.

Wonderful world of underground caves

Underground caves located in the territory of the Samara region are impressive natural sites.

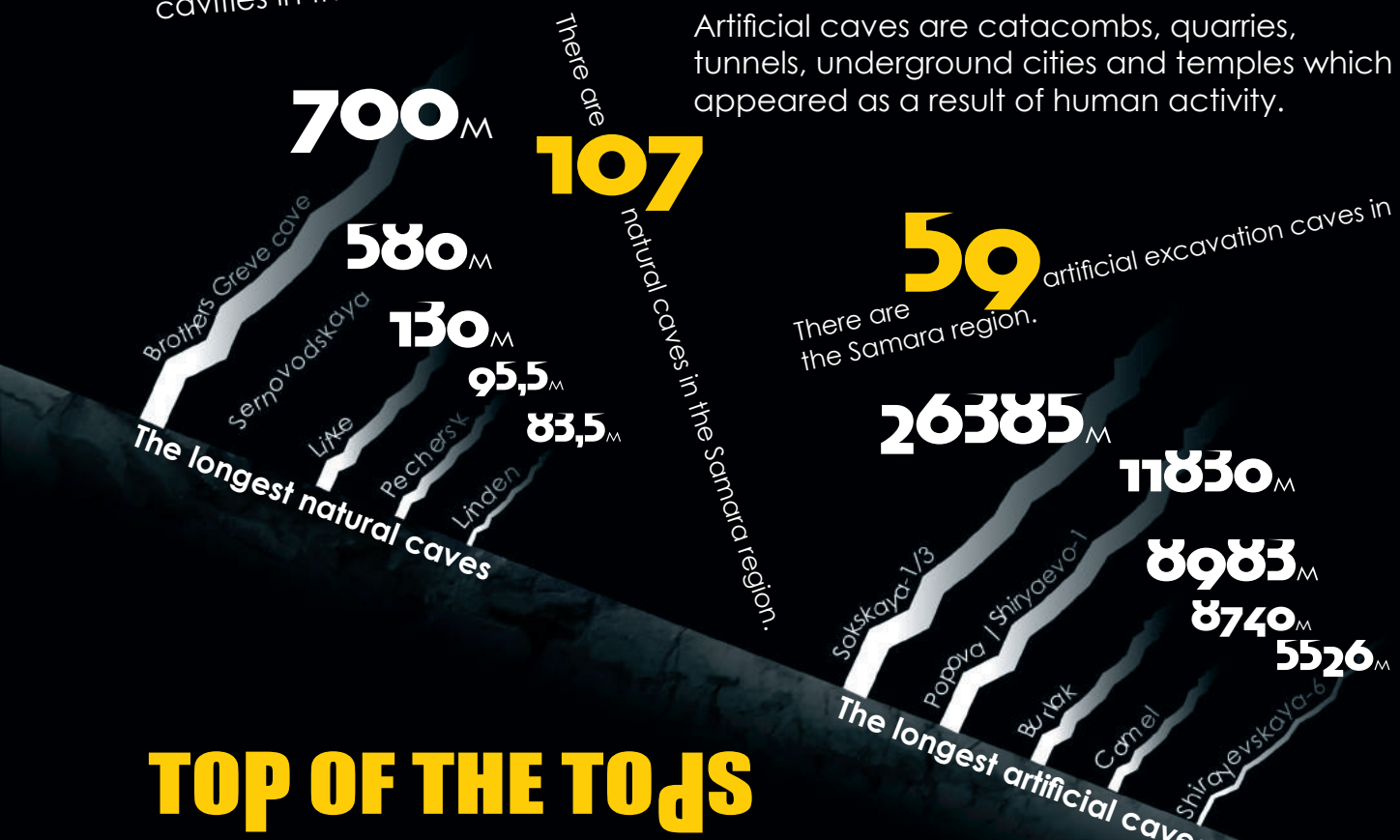
Currently, speleological fund of the Samara region includes **166** caves with total length of **73 732** м

Natural caves are naturally formed underground cavities in the earth's crust.

There are **107** natural caves in the Samara region.

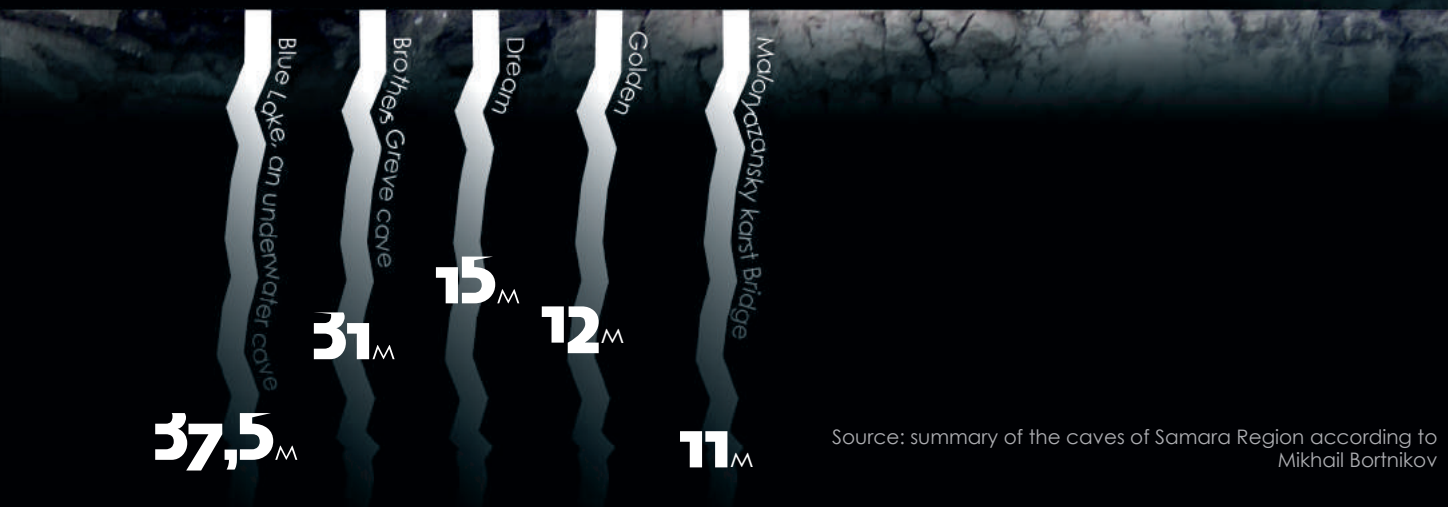
Artificial caves are catacombs, quarries, tunnels, underground cities and temples which appeared as a result of human activity.

There are **59** artificial excavation caves in the Samara region.



TOP OF THE TOPS

The deepest natural caves



Source: summary of the caves of Samara Region according to Mikhail Bortnikov

MAIDEN'S TEARS IS SPELEOLOGIST'S JOY

Scientific research in caves can bring surprising results

By Svetlana EREMENKO

What makes a man crawl around the dark and cold insides of the planet on his own free will and then take the dirt, droppings and God knows what else on his clothes and shoes to his city apartment? Mikhail Bortnikov, senior lecturer at the Chair of Geology and Geophysics of Samara State Technical University, knows the answer to this question.

Look into the well

He is a geologist so topographical surveying of caves is not his duty. At first speleology was just **Bortnikov**'s hobby but now it is his main occupation. Mikhail has been searching and describing caves for thirty years.

Bortnikov graduated from Miass Geological Survey College. After graduation he worked in the City of Ufa and completed extramural studies on the discipline of mineral geology at Moscow State Open University.

"Once my friends and I were reading a book entitled 'Columbuses of the sixth ocean' by the famous geologist, speleologist and traveler **Simon Baranov.** In this book the author talks about little-known Ural caves. So we decided to find them using the author's description," Mikhail tells. "We walked around all this area, found all underground cavities described in the book and discovered several natural shafts. But we couldn't find a cave called 'Steshkin's well' (that's how it was called in the book) even though we tried at least ten times. During this journey I realized that I was more interested in searching for new holes hidden by heaps of stones and bushes using blurred descriptions rather than loiter about the underground caves – further, deeper, faster."

So eventually this book became a life guide for Mikhail. Bortnikov made an inventory of Chelyabinsk caves and then moved to Samara in 1994. Quite soon he realized that there were many speleo-enthusiasts there but also numerous gaps in speleology.

Prospective karst

Local speleo-enthusiasts and scientists were inspired by the idea of counting and measuring all caves of the region proposed by a newly arrived speleologist. They formed a team consisting of geologists **Nickolay Nebritov** and **Nickolay Pudovkin**, speleologist **Dmitry Isaev,** biospeleologist **Alexander Metyolkin,** major speleology expert **Victor Bukin,** quaternary deposits expert **Eugeny Nikitin** and others. There was a record

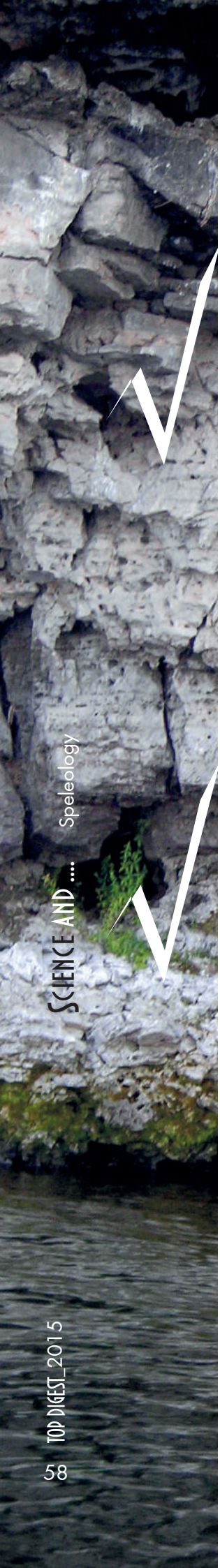
▲ The entrance to the Kuibyshevskaya cave is very narrow and barely noticeable.

card for each cave. At first there were 43 caves in the Samara inventory. The Greve brothers cave was the first in this list, of course; it is still the largest and deepest caves of the region (700 m long and 31 m deep). The smallest cave called Kosulya was there too; it was discovered in 1957. What makes this cave famous is that the experts from Zoological Institute of Russian Academy of Science collected more than 1000 bones of animals and birds there. Later speleologist **Andrey Kudrin** gave his speleological archive to Bortnikov.

Every year speleologists from Samara search for big and small 'holes' in the ground (an underground cavity is considered a cave if it is more than 10 m deep under the surface). 'Hunting season' starts in May and ends in October or November. Previously Samara region was considered as a non-prospective karst area; today geologists, biologists and historians from all around Russia are interested in the caves of the region. In 2008 the 100th cave called Tanyusha was discovered; it is situated inside the Mogutov mountain between the Volga hydro-electric power plant and Morkavshi.

Mushrooms in shafts

Each new cavity is registered and topologically surveyed (top view, cross-cut view). The materials are then published in the 'Speleology of Samara region' magazine. The eighth issue of this magazine was put out this autumn. The magazine is financed by enthusiastic speleologists. No authorities have yet come to the idea of supporting the research with grants or any other form of financial assistance. And there is still no response to numerous calls of speleologists to include some of



the most interesting caves into the list of specially protected areas.

The speleologists have received money for their research only once. In 1999 several people died in the Sok shaft but numerous attempts to block the entrances to caves and thus prevent people from going to the dangerous area were fruitless. The authorities realized that unexplored caves should be examined. So today many researchers work in the Sok shaft which is the third longest shaft in Russia (their overall length is 26385 m); underground orienting competitions also take place here.

"By the way, this year scientists from Samara finally managed to discover one of the wonders of the Sok shaft," Mikhail says. "There are mysterious plants – we call them lianas – that come down from shaft beams to the ground. Researchers couldn't understand what it was and when they finally did it caused a scientific sensation. These plants turned out to be mushrooms – ordinary mushrooms."

107 natural and 59 artificial caves have been discovered and described in Samara region to this moment. The overall measured length of natural underground cavities is 73732m.

Hidden beauty

Almost every year Bortnikov's team discovers something new in the fields of history, biology and geology. For example, several artificial caves up to 100m long were discovered not so ago at an extremely beautiful tract called the Racheisky Alps in Syzran region. Bortnikov thinks that local people used to extract glass-making sand there about one hundred years ago. But it's also possible that stones were taken from the ground for some religious reasons. The biggest underground cavity is called Kil-Keremet – the Mordovian for 'Home of God'. One of the most beautiful (in the geologist's opinion) caves of the region is also situated there, in the Racheisky Alps; it is called 'Maiden's tears'.

"This cave astonished us when we found it," – Mikhail says. "No surprise that local people have been hiding it so carefully and for such a long time. It looks like they didn't want this beauty to be destroyed by ignorant tourists. Yet the nature itself did its best to conceal it. The huge entrance to the cave – it's an arch 20m x 3.4m – is hidden behind the 4 m high water wall. A waterfall right above the entrance. When you enter the cave you get into a 8m long grotto; then you get into a passage, it's 3m wide, 1.5m high and 18m long. In the end the passage get narrow and finally there's a dead end. The whole cave is 220 square meters."

Today the Kruber-Kuibyshevskaya underground system is acknowledged the deepest in the world. Its explored depth is 2196 m.

Communicating vessels

Divers from Samara did a very interesting discovery from the speleological point of view.

In 2007 they found a grotto 18m under the surface of the Blue Lake in Sergievsk region. Two years ago during the training divers saw that the bottom of the lake had collapsed and formed a horizontal passage. The divers managed to go inside for about 50m before it became too dangerous to proceed as the rocks could collapse any minute.

"It's not an ordinary lake," Bortnikov says. "As the matter of fact it's a kind of flushing valve of underground river which gets to the surface and flows into the Shungut river. This valve is situated in the active karst area and this fact explains these constant changes of the lake."

Today the Blue Lake is considered to be the deepest karst lake in Russia. There is another lake next to it; it also was formed by karst processes. These two lakes are not connected on the surface but speleologists believe that they are joined by underground channels.

Abyss

This year local speleological enthusiasts confirmed the high level of Kuibyshev-Samara speleologial school by reaching the lowest vertical limit of the planet.

Karst cavity Kruber-Voronya of the Arabika massif (Abkhazia, West Caucasus) explored by Georgian speleologists in 1960's is today's champion of 'vertical races'. Today it is considered to be the deepest in the world. But in 1979 enthusiasts from our city found the way to the cavity previously unknown to the researches of the deep; it was situated near the entrance to the Kruber cave. This

cave was named after minor motherland – Kuibyshevskaya. Those days speleologists managed to go only 160 m so the researchers had no idea about the actual size of the cave; still it was claimed to be the deepest in the USSR. In order to prove that, a team of speleological enthusiasts from our city used to go to the Caucasus every year. They went down deeper and deeper. As they were going down the discovered more caves. In 1980's Russian and Ukrainian speleologists explored hundreds of caves at the Arabika plateau; it was the golden age of Soviet speleology.

At that time a unique experiment to study the hydrogeology of Arabika was carried out. Water in the spring at the top of the mountain (2300 m) was coloured; it flew down into the cracks in the rocks and eventually went out in eight brooks at the foot of the massif. Experiment showed the researchers that there was the world deepest hydrosystem inside the Araika massif. All they needed to do was to explore and walk through that labyrinth of caves following the underground waters.

Vertical limit

No Russian expeditions went to those mountains after the first military conflict between Georgia and Abkhazia. Researchers from Samara returned to the valley of Arabika only in 1999. The new generation of our speleologists are obsessed by the same idea as were the speleologists in the late 1980s: the idea that two major cave branches – Kuibyshevskaya and Kruber-Voronya – are connected. Speleologists moved deep to the Kuibyshevskay cave discovering new chambers and galleries and giving them romantic names. That's how names like Rain Song or Northern Wind appeared on the topographical map of this underground area. In 2006 speleologists from Samara discovered more minor branches.

"A gallery called Winter Garden (there were very fragile calcite crystals there) was considered to be the most prospective of them; it lies more than 600m under the surface. Everybody was happy then as we thought that we found a prolongation of the Kuibyshevskaya cave. -Mikhail remembers - but it turned out that the gallery led to the chamber we already knew – it was called the Hall of Academy of Science; the gallery fell into it almost under the ceiling".

At the same period Ukrainian researchers worked in the underground system of the Kruber-Voronya cave. In 2006 they went down and reached the point of 1710m. It was the world record. But the exact joint of two caves – the one discovered by the speleologists from Samara in 1979 and the Kruber-Voronya cave –was never found.

Last year speleologists from Samara found a small galley in the Kuibyshevskaya cave at about 400 m under the surface. It could be seen at the very top of the chamber called 1500th 'Anniversary of Kiev'. This tunnel was named the Svetlankina Gallery. There was a strong draught in it which meant that this tunnel wasn't blind. That time speleologists simply had no time to explore it carefully.

It was only at the end of this summer when the topological survey done by speleologists from Samara and other regions confirmed the idea that our fellow townsmen came up with back in the 1970's: the Kuibyshevskaya and the Kruber-Voronya are two branches of a large underground system.

"Will there be 'exhibition performances' of any kind? For example, passing through the tunnel or descending to the Kruber cave and ascending from the Kuibyshevskaya?" Bortnikov wonders. "We don't know yet. This issue is under consideration."


TOP DIGEST_2015

LOST IN STEPPES

A story about amazing things sometimes found under the feet of SSTU students and lecturers

By Eugenia NOVIKOVA

In the beginning of May a group of SSTU geologists went on an expedition to Chelyabinsk region. Lecturers of the Chair of Geology and Geophysics together with enthusiast students explored open casts around the Arkaim native reserve in order to find the best way of carrying out a summer practical training for the first-year students.

Findings along the way

The road from Samara to the destination point – the village of Alexandrovsky in the south of Chelyabinsk region – took almost two days. I traveled together with students and lecturers along bumpy Russian roads on the truck choked up with huge rucksacks, boxes with cereals and canned food – meals for real explorers of plains and uplands. Looking at how easily the members of expedition cope with travel inconveniences and listening to endless conversations about geology spoken on a language that a non-geologist won't understand, I easily believed that these people are ready to sacrifice their lives just to define the absolute age of rock.

One of manifestations of selfless love for geology occurred near a motel in Bashkiria. The SSTU geologist took away a motel flowerbed bit by bit. It turned out that ignorant motel employees had surrounded the flowers with not ordinary rocks but stromatolites. Judging by voices and shining eyes of Samara geologist, that was very important finding.

"These rocks are to be prayed to – they're the origin of earth!" exclaims senior lecturer at the Chair of Geology

Historical and cultural reserve 'Arkaim' is situated in Chelyabinsk region between the villages of Alexandrovsky and Amursky. It was established in 1991 on the area of fortified settlements of 3000-2000 B.C. Archeological monuments of Bronze Age found at the territory of Arkaim are of great scientific and cultural importance. They prove that South Ural was populated by civilized people 3-4 thousand years ago.

and Geophysics **Mikhail Bortnikov** as the truck was chugging down one of endless Russian roads.

Look into distant past

As the geologists arrived at the destination point they decided to look around before plunging into exploration of hidden treasures of South Ural. The area chosen for summer practical training of students was unique indeed: the village of Alexandrovsky established in 1904 by migrant Cossacks from Orenburgskaya province is situated on the territory of the historical and cultural reserve 'Arkaim' which is a branch of the state reserve of Ilmen. The first two days of the expedition were spent on excursions around this extremely interesting area.

"We decided to carry out the geological practical training here because this region is extremely rich in geological and archeological objects," says **Alyona Konovalova**, chief of expedition, senior lecturer at the Chair of Geology and Geophysics. "There are a lot of sedimentary rocks in Samara region that we study on the first stage. But there are no igneous and metamorphic rocks. Moreover, by communicating with archeologists we widen our mental outlook, we help each other in research, share our experience and knowledge. Cooperation of two sciences – geology and archeology – can lead us to some new discoveries."

Our geologists visited several reconstructed nomad camps of bronze, stone and early iron age, and went to the reserve museum. The wife of one of the discoverers of ancient settlement called Arkaim (Turkic for 'spine' or 'back') **Gennady Zdanovich**, Candidate of Historical Sciences **Svetlana Zdanovich** was their guide.

"This is the most visited place in Chelyabinsk region," she says. "About 15,000 tourists came here last year. All settlements were reconstructed precisely according to drawings and it was something like a scientific experiment: we wanted to show that structures built by ancient people are able to stay and satisfy basic human needs."

Expert of one monument

Gennady Zdanovich told the geologist from Samara some more facts about that amazing place. In the evening of the third day of our travel the Professor of Chelyabinsk State University, Doctor of Historic Sciences, general manager of the historical and cultural reserve 'Arkaim' came to our camp.

"In autumn of 1987 I saw that very thing I had been searching for all my life," Zdanovich explains. "A fortified proto-town, an illustration of a highly developed ancient civilization. At that time a 'construction of century' began here: a water-storage basin at the confluence of rivers called Bolshaya Karaganka and Utyaganka. In two years we 'opened' the area of about 10,000 square meters. Usually archeologists don't work so quickly but we were running out of time as the area was supposed to be flooded. In 1991 we finally managed to uphold those settlements and construction was cancelled. And we started to explore the houses we had found. Arkaim for me is an example of heroic era, time of innovations, when humans outdid themselves. Just imagine: storm sewage was built here 4,000 years ago! People of Arkaim were the first in the Ural steppes to build round and rectangular urbanized settlements where everything was planned up to a centimeter. Besides, as it turned out, citizens of those very settlements invented the oldest battle chariots."

Stromatolites are formations of unusual shelly texture, result of vital functions of ancient unicellular organisms similar to cyanobacteriae. Stromatolites are of scientific and practical importance in terms of geological mapping and mineral exploration including oil and gas.

Zdanovich told us that only a half of reserve territory had been dug so far. He thinks that it's better to leave the second half as it is in order not to damage the underground artifacts. Modern archeology is very complicated and laborious process,

▲ Top view of the model of fortified Arkaim settlement looks like a sea shell. According to experts, the population of such 'town' could be about 2000 people.

representatives of international societies should participate in the digging process; after all, special research method is required but there isn't any so far.

Rocks are more precious than gold

Having got acquainted with cultural heritage of South Ural, the SSTU geologists took their hammers, notebooks and rucksacks and began to explore its geological legacy.

The geological survey started near the mine where gold is laundered – literally. Next to it there was what remained of an open cast; our researchers found many pieces of malachite there, as well as chessylite, ore and so-called aerugo – changed many-colored minerals. As usual, the first deposit turned out to be the most interesting.

"I have been collecting rocks for two years already, I've got an entire museum at home," says the third-year student of Saratov State University **Denis Hudyakov**; the SSTU students had offered him and three other students from Saratov the chance to join the expedition. "I believe that a geologist must be an all-round educated person who knows some other things apart from just where to drill for oil. Expeditions like this are necessary for widening mental outlook. We should study effusive rocks (rocks of volcanic origin – Author's note), sometimes they are extraordinarily beautiful."

▼ Charming beauty of residual soil on copper-ore deposit.

That day the members of the expedition saw many interesting samples of volcanic and metamorphic rocks; there was one more thing – the process of gold-mining. Mikhail Bortnikov managed to arrange a small tour of the nearest mine. The entire process of extraction of gold from ore was briefly explained to the students; the process itself doesn't look very interesting – most people would pass by without even noticing. Only 2 grams of gold are produced out of one ton of ore after several stages of industrial treatment.

Just don't look down

By the end of the expedition the geologists had explored seven open casts. In one of them chromium, nickel and phlogopite (kind of low-iron mica – Author's note) were produced; in other one serpentinites are still produced from time to time; in the third one our geologists managed to find some pieces of quartz. The students could see with their own eyes what they had read about in the books or heard in lectures.

"Geologist should go on expeditions, see the rocks in areas of their natural occurrence, examine the rocks n section," lecturer at the Chair of Geology and Geophysics of SSTU **Alexander Konovalov** convinced us.

Of course, there wasn't enough space in rucksacks, sacks and pockets for all valuable and rare samples, even though the rocks seemed to be everywhere in the truck. Even in camp pots, cups and mugs. As they were leaving the last open cast, Alyona Konovalova urged the second-year students not to look down in order not to come upon some more interesting things accidentally.

1 A hammer is the main tool of a geologist. Apart from it a real professional should have a compass and a notebook to make notes and draw rock sections.

2 It takes one ton of gold ore and sophisticated industrial processing to get 2 grams of gold.

3 Covelline tarnish paints slate cracks in all shades of blue.

LIGHT AND DARK

Samara State Technical University carries on the brewing traditions

By Maxim ERYOMIN,Olga NAUMOVA

On the ninth day of the ninth month Ghan-ghan-ed in 2620 B.C. priests of holy Sumerian town called Nippur were very upset. Roof of a large barn near the main temple leaked. Barley inside got wet, it swelled and started to sprout. High priest was black as thundercloud: "Now we've got no bread left!".

It's still a mystery who at that dramatic moment came with idea to use that barley malt to make a drink that later conquered the world. But what we know is that brewing technology invented at the epoch of Sumerian-Babylonian civilization (4000-1000 B.C.) hasn't changed much over the centuries. Malt is still mixed with water, filtered, boiled, cooled and fermented by yeast.

Various additives create a plenty of beer specialties. For a long period of time almost everything was used to give beer a flavor – heather, mint, coriander, wormwood. But the hop has been the main beer 'spice' over the last few centuries; it makes the drink taste nice and, what's more, increases foam retention and density.

No wonder beer is brewed, wonder it's still here

SSTU has been brewing beer since 2001 – on a scientific basis. There is a laboratory of fermentation process at the Food Production Department; this lab includes a mini-brewery. Students get theoretical knowledge and, what's more important, practical skills necessary for a real brewer.

Laboratory tutors say that their graduates leave and never come back. Some go to Yakutsk, others to Ulyanovsk. Some graduates stay in Samara and work at small breweries. Trained specialists are in demand everywhere: at big breweries, cafes and restaurants. But where do these specialists come from?

Today Samara State Technical University is the only institute in Samara region which trains brewing specialists. The mini-brewery in the university is fully-equipped: impeller grinder, mashing apparatus, filter tank, brewing kettle, plate heat exchanger, fermenting tanks, postfermentation tanks, six-stage water treatment apparatus – everything a brewer needs to make high-quality beer.

Officially patented specialties called 'Rus', 'Mozhevelovoe' and 'Alpiyskoe' are produced under the SSTU 'Vozrozhdenie' trade mark today. Moreover, scientists at the Chair of Food Production and Perfume and Cosmetic Products established a strict procedure: each group of students that undertake training in the lab must come up with its own, unique beer specialty and brew it. It is called 'creative approach to profession'. Sometimes future brewers make trailblazing experiments adding pumpkin, mint, briar, cherry juice and honey to traditional recipe. Thus, 23 new specialties have already been created, some of them taste very unusual.

In aqua veritas

In Sumerian mythology goddess Ninkasi was patron of brewery. In SSTU it's **Nina Stepanenko** who patrons future brewers. She gave more than 40 years of her life to brewing; now she is a chief engineer at the Chair of Food, Perfume and Cosmetic Production Technology and can learnedly discuss brewing issues for hours.

"We brew only so-called 'live', unfiltered beer which consist of malt, hop, water and low fermentation beer yeast. We don't use any organic ferments and conserving agents that are extensively used by many modern brewers to accelerate the attenuation process and increase storage period. Just think – why should it be stored for a long time? If beer is produced, people should drink it. But not get drunk."

Much foam in beer – is it good or bad?

"Foam forms on low fermentation beer; it's 7-12 degrees centigrade (high fermentation requires no lower than 15-20 degrees. – **Author's note**). The lower the temperature, the more carbon dioxide produced by attenuation stays in beer. Foam is considered to be a sign of high quality, it forms because of protein cleavage. Foam retention, its height and density are very important in this business."

Today many people are very anxious about calories and healthy food. Is it right that beer is not good for healthy life style?

"Not at all. As for calories, beer contains relatively few of them: 40-50 per 100 g. If you drink beer without much snack-food than you don't need to be worried about your weight. One litre of beer a day per 65-70 kg of weight is rather sensible amount from dietological point of view. Now let's talk about good things beer does for your health. Drinking 'live' beer gives positive effect on metabolism, prevents wrinkles and stimulates appetite. Moreover, it contains seven groups of vitamins B1, B6, B12, E, C, H and vitamin A. And vitamin A can be found in carrot and mespilus only."

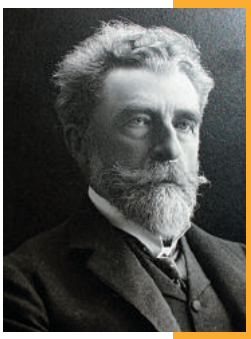
Could you please explain why Samara-brewed beer is still so popular among our people after all these decades? What's its secret?

"Water. Very much about brewing depends on quality of water. Samara brewers have always used water from the Volga river. It gives beer a special flavor. Moreover, its Ph level is 5.4-5.6 which is ideal for brewing. **Alfred von Vacano** deliberately built his brewery on the Volga bank. He took raw water from river, shipped the finished product by river all around Volga region, and in winter his workers used to break ice into blocks to use them as refrigerators. It was not enough. 7 water wells were drilled at the territory of the brewery; they provided naturally filtered water to the brewery. In Soviet Union times Samara-made (Kuibyshev-made) beer 'Zhigulyovskoe' won the first prize at the All-Union beer competition and thus became the standard for Soviet brewing industry. **Alexander Kasyanov**, chief brewer at Zhigulyovsky brewery, played an important role in development of Samara brewing; he was the only Hero of Socialist Labour among Soviet brewers."

Rules for tasting SSTU beer:

1. Beer must be 10-12 degrees centigrade. This temperature provides the best feel of hop aroma.
2. Take a sip, savor it in your mouth, than swallow. If you feel like taking another sip, it means that beer is good.
3. The best beer snack is some hard cheese or home-made dentils

Outstanding brewers of Samara



Alfred von Vacano

Was born in 1846. In 1881 established Zhigulyovsky brewery in Samara. The brewery produced several specialties of beer including 'Zhigulyovskoe' and 'Venskoe'. His brewery supplied its beer to 60 cities of Russia. By 1914 his brewery had been awarded with 15 highest awards particularly at international brewing exhibitions in Paris (1900), London (1902 and 1903) and Rome (1903).

Alexander Kasyanov

Was born in 1888. Worked at brewing industry since he was fourteen. Worked at the brewery in the city of Slobodsky, was the chief brewer at breweries in Krasnoyarsk and Ufa. In 1946 moved to Kuibyshev, created a new specialty of beer called 'Samarskoe' at Zhigulyovsky brewery. The Hero of Socialist Labour.

Nina Stepapenko

Hereditary brewer with 44-year experience. Graduated from Novocherkassk food industry college (Rostov region) and later the Chemical-Technological Department of Kuibyshev Polytechnic Institute. Worked at Zhigulyovsk brewery for 28 years, made her way up from digesterman to acting chief brewer at the enterprise. Supervises fermentation process laboratory at SSTU.

IN VINO VERITAS

SSTU wine-making: FAQ

By Olga NAUMOVA

It seems like the healthy properties of wine have been known ever since it was invented. Wine was considered as holy drink in ancient Greece, white wine was used for disinfection of water. Aristotle called it 'Milk of Venus' and French microbiologist Louis Pasteur believed wine to be the healthiest and most hygienic drink 'if drunk moderately'. Two years ago a laboratory was opened at the Food Production Department, and students and postgraduates began practicing their wine-making skills there. Obviously, this SSTU project was 'doomed' to success as well as famous SSTU cheese dairy. 'Technopolis of the Volga Region' answers the most frequently asked questions coming from our friends, colleagues and partners.

1. Where does SSTU get grapes from?

From Samara farmers that grow industrial varieties of grapes SSTU buys three varieties of white grapes ('Platovscky', 'Crystall' and 'Cytronny Magarach') from **Victor Klemanov**, a farmer from Ust-Kinelskiy. **Sergey Eliseev** grows red grapes; on his farm in the village of Olgino (Bezenchuck area) he cultivates 'Livadian black' and merely French types – 'Merlot' and 'Pinot'. **Vladimir Bakharev**, dean of the Food Production Department at SSTU, Doctor of technical sciences, believes that Samara region provides favorable conditions for both growing grapes and wine-making. Region-grown grapes gain up to 20-21 per cent of dry matters which is fairly enough for making quality dry wines. On the other hand, grape variety called 'Isabella' found almost on every farm around the region can't be used for wine-making: experts say it contains a lot of methanol which is poisonous.

"Anyhow, we should eat and drink stuff that was made in our region because it's healthier," the dean remarks fairly.

2. Who drinks SSTU-made wine?

Many people ask this question with envy and/or interest. Vladimir Bakharev smiles as he answers:

"Various presentations for our partners and foreign counterparts often take place in our university; it also participates in exhibitions. It's very nice when there's some home-made product that you can entertain your guests with! We give our wine as a present, we arrange degustation events, we entertain our guests. This year we got 200 litres of 'Cytronny Magarach', 150 litres of 'Livadian black' and about 50 litres of 'Pinot'. Wine-making process itself takes place in the end of August – beginning of September, so we have already tasted young wine."

Everybody knows that young wine and aged win differ in taste. SSTU laboratory has been studying biochemical processes – particularly the way wine properties change – for two years.

3. Who is the chief SSTU wine-maker?

Pavel Chaldaev, associated Professor at the Chair of Food, Perfume and Cosmetic Production Technology, is the chief of the laboratory. The center trains second-year students who will become wine-makers or, to be more precise, technologists of preparation of fermentation industry and wine-making (Food Production Department trains such specialists). Next year they will go to some winery for practical training, and lecturers will go the 'Massandra' plant in Crimea – SSTU has signed an association agreement with it.

4. Are there any production secrets?

Although based on traditional methods, wine-making still has some peculiarities.

Not long ago SSTU specialists visited the 'Noviy svet' winery in Crimea. This is one of the oldest Russian enterprise of this kind founded by the chief wine-maker of the Russian Empire knyaz **Lev Golitsyn** in 1878.

The SSTU champagne is made using the classic method according to which champagnization is carried out inside the bottle. Sugar and yeast are put into dry wine and it starts to ferment. Bottles are stored in a special cooler with temperature of slightly above zero; they are stored at certain angle so yeast gradually comes down. Then bottles get opened, sediment is removed and wine becomes a finished product. The SSTU wine-makers are still unable to remove sediment completely yet, but it's just a matter of time.

5. Are there any additives and conservatives?

Quite often ferments are added to wine during making to age or brighten it and to get as much juice from raw material as possible.

"We never use ferments," Vladimir Bakharev says. "In general, we try to use as few additives as possible. Even sulfitation is carried out in fewer amounts than required. Thus we get a more natural product even though it becomes less stable. I'm for using natural raw materials without any additives. Why spoil good finished product?"

6. Who pays for all this?

The winery is financed by SSTU. This is a training laboratory and scientific center, not an industrial enterprise. Stainless steel tanks were made at Novokuibyshevsky oil refinery plant.

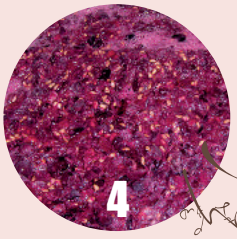
WINE-MAKERS' RULES

HOW wine is made

Grapes go through the stemmer

Then through the grinder

Then put into fermentation tanks



Grapes ferment

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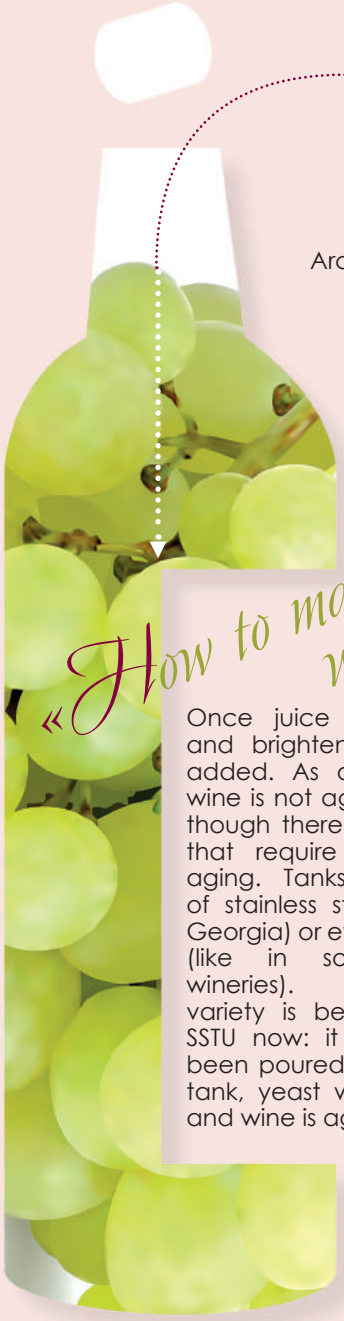
Finished wine is bottled by hand. Colleagues from Samara State Architectural University made labels for bottles.



«How to make white wine»

Once juice is squeezed and brightened, yeast is added. As a rule, white wine is not aged in barrels though there are varieties that require 3-6 months aging. Tanks are made of stainless steel, clay (in Georgia) or even concrete (like in some French wineries). 'Platovsky' variety is being aged in SSTU now: it has already been poured into another tank, yeast was removed and wine is aging.

«How to make red wine»

Initial fermentation is carried out on pulp. It means that grapes after grinding are left for fermentation. Pulp forms a 'cap'. Wine is periodically poured of from the bottom and then put on 'cap'. Firstly, this way wine gets saturated with oxygen and gains its color. Secondly, constant pouring of wine on cap stops bacteria from propagating so they don't infect wine. Wine is permanently renewed. After initial fermentation the pulp is squeezed and wine begins to age.

WINE

4 types

NON-SPARKLING WINE – table wine, alcohol content less than 14 per cent (e.g. claret and Rhine wine)

SPARKLING WINE – name speaks for itself (e.g. champagne), alcohol content less than 14 per cent

FORTIFIED WINE – 16-21 per cent (e.g. port wine and sherry)

AROMATIZED WINE – 15.5-20 per cent of alcohol (e.g. vermouth)

Over 600 organic and non-organic components:

TASTE EXPLOSION

In Samara State Technical University the production of freeze dried food is set up.

By Tatiana VOROBYOVA

What will happen if we combine the culinary art with the scientific achievements in the field of physics and chemistry? We'll have molecular cooking, the invention of the late twentieth century. It gives the master an opportunity to experiment with the ingredients, tools and cooking technology and even change the texture and shape of the products. The experiments in this field are carried out at the Faculty of Food Production of Samara State Technical University.

Mild drying

One of the techniques used in molecular cooking is freeze-drying. This technology in Russia is not very common and is certainly of interest to researchers.

Sublimation of products, mainly fruits and vegetables, is carried out in a special unit in a new laboratory at the Faculty of Food Production. The process of lyophilisation, or mild drying takes place in a vacuum environment at low temperatures and at reduced to nearly zero pressure. The moisture in the state of ice evaporates from the product placed in the freeze drier without changing into a liquid form. The resulting vapor is deposited on the condenser.

Some berries such as strawberries and raspberries keep their original shape, texture and color. The volume slightly decreases but the weight is significantly lost. The weight change occurs due to the fact that the residual humidity of the product is only 3-4 percent. It's impossible to gain the same result using convection drying.

The sublimation process can take up to two days. Its duration depends on the thickness of the slices.

The term "molecular gastronomy" was introduced by the French chemist Hervé This and the British physicist Nicholas Kurti in 1992. Currently, this is a branch of food science that investigates the physical and chemical transformations of ingredients in the process of cooking.

Tastes differ

The laboratory table is decorated with freeze-dried plums, raspberries, currants, strawberries, gooseberries, cherries, bananas, apples, pumpkin and kiwi. Degustation shows that the taste of these berries is stronger compared to the fresh ones. For example, freeze-dried gooseberry has a stronger sour taste, and berries containing a lot of sugar have very sweet taste. The nutritional value of products increases due to the removal of moisture.

However, freeze-dried fruits lose natural fragrance. But as soon as they start to interact with the water the smell appears again.

"Absorbing moisture they acquire the properties of natural products," – explains Tatiana Bykova, the assistant of the department of Technology and catering arrangement. "This relates to juices too. For example, we dilute the sublimated carrot juice with water, and within five minutes it takes the color, flavor and aroma of the natural carrot juice. The research conducted shows that they save all nutritional properties. After lyophilization their concentration in the product increases".

In one of the experiments the staff of the department tried to dry apple slices with cinnamon and glaze. As a result we have apple chips with the novel taste.

Freeze-drying may be used even for fresh milk resulting in a white powder.

Space food

Freeze-drying has a definite advantage as compared to other methods of preservation. As the product has almost no moisture, its pull date increases significantly.

Freeze drying technology can be useful in the development of food for astronauts. Food taken into space must be light-weight, compact, tasty and nutritious. Fruits and vegetables are rich in vitamins and minerals, they are indispensable for an astronaut's diet. Moreover, the raw material is grown in the Samara region.

"On the Earth" freeze-dried fruits and berries can be used as decoration for salads, desserts and other dishes. Meat, for example, goes well with cranberries. Since freeze-dried fruit quickly absorb moisture, you should decorate the dishes immediately before serving.

Sublimation is the transition of a substance directly from the solid to the gas phase without passing through the intermediate liquid phase. Nowadays it is widely used for storing products with all the minerals and useful substances for a long time.

Hot and cold

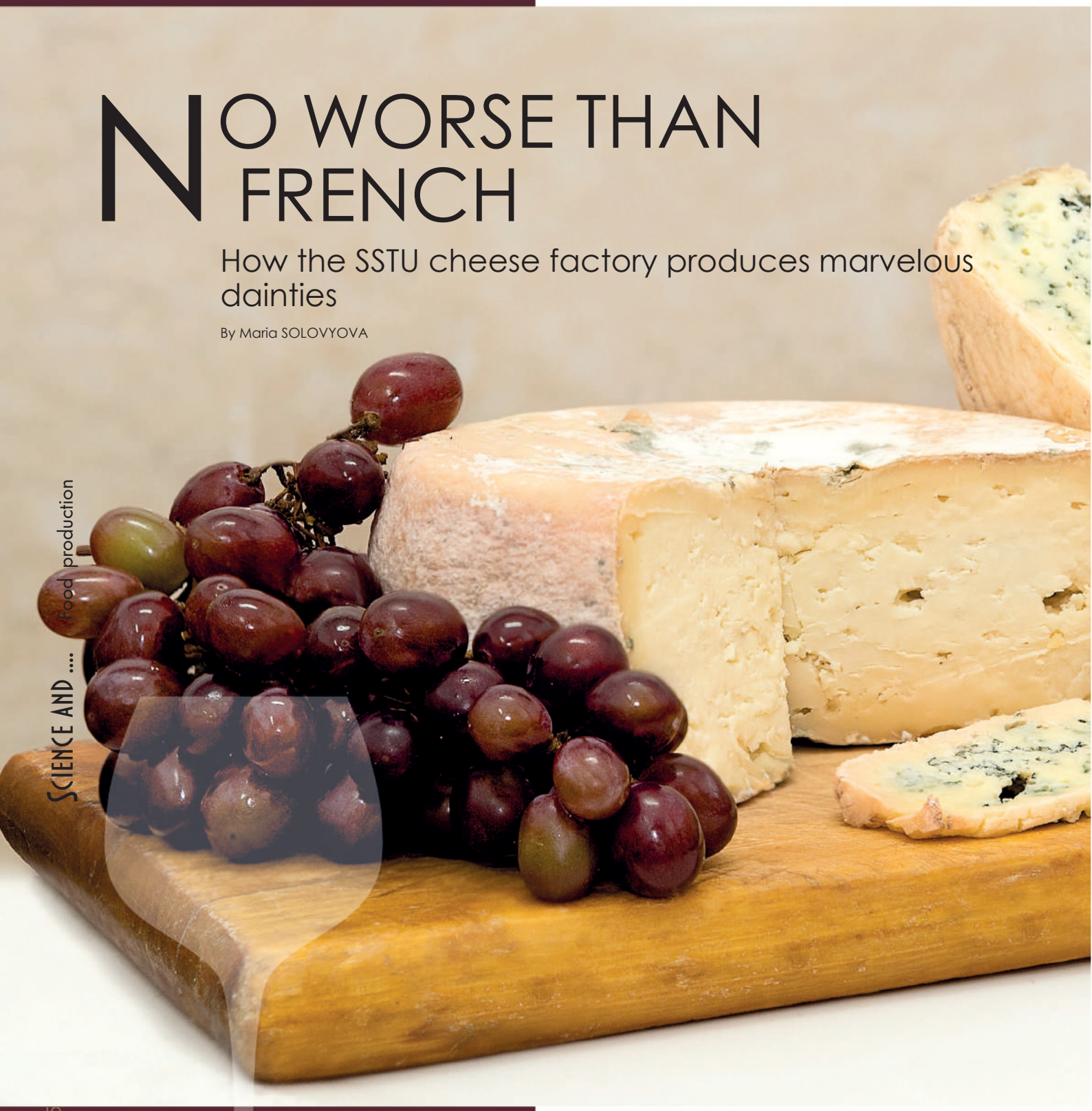
Freeze-drying is not the only technology used in molecular gastronomy. There are widely used technologies such as liquid nitrogen freezing, boiling and roasting at lower temperatures, the addition of small amounts of sodium alginate or calcium chloride to obtain pearly droplets or jelly. These products can provide unexpected and pleasant tastes and go well together with the products that do not match each other under normal conditions.

For example, liquid nitrogen provides an unexpected effect in cooking meat. After heat treatment the hot meat is immersed in liquid nitrogen, and then while eating it you feel cold and hot effect at the same time. We call it the “taste explosion” because it is based on the contrast.

NO WORSE THAN FRENCH

How the SSTU cheese factory produces marvelous dainties

By Maria SOLOVYOVA



Since the import ban, cheese has disappeared from the grocery shelves due to economic sanctions, and Russian manufacturers have been unceasingly searching for an alternative. The experimental manufacturing of this product began the previous winter in the SSTU food production faculty. For now, the result lives up to the expectations: the first party of cheese blocks with overall weight of approximately 50 kg has already matured; the September degustation of Dorblu, Parmesan and other sorts of cheese of SSTU production, attended by Samara and Moscow journalists, and also the honorary consul of Italy in Samara, a true devotee and expert in dairies, Janguido Breddo, has become the true triumph of the university cheese-making.

Natural Roquefort

In SSTU traditional technologies and only natural materials are used for cheese production.

Before the beginning of the technological cycle, teaching assistant of the "Technology of food productions and perfume-cosmetic products" **Anastasia Melentieva** performed a spectral analysis of milk composition. The values of fat and protein are defined via brand new method developed in SSTU – by means of the multi-dimensional data model.

"In order to make cheese tasty, milk shall contain more than 2.8 percent of protein. And the value of fat shall exceed the value of protein by 1.1-1.5 times", – says Anastasia.

The milk that is supplied to the University by the "Kriazh" state farm, completely meets these requirements. According to the Roquefort cooking technology, the milk shipped in evening is kept until morning: thus, its acidity increases, and then it's considered as "matured".

And then, in the morning, the main act begins in the milk biotechnologies laboratory managed by the head teacher of the "Technologies of Public Catering" department, the Candidate of Technical Sciences, **Anna Borisova**.

Home-grown mould

When cooking Roquefort, milk is not pasteurized. It is poured in the cheese cooking bath (biofermentor) right away, warmed up to 32°C, and the leaven of mesophilic culture is added into it, as well as the mould cultures. (Since the mould production that requires special conditions is not set in Russia, and it's not manufactured on industrial scale, the faculty stuff performed breeding in advance, putting mould cultures from original mould-containing product to the milk. In other words, the mould is home-grown).

Thirty minutes later, milk-clotting ferment is put in the mixture. Soon, the milk coagulates and becomes of the same consistency as butter. The resulting cheese curd is cut, so that the cheese grains are of 5 mm. The blending for cheese whey separation takes almost an hour.

In cheese-making, it is vital to catch the moment when the cheese grain achieves the necessary consistence, becoming sticky.

"We can't miss this moment. If the handful of cheese grains falls apart in easy shaking, it is time to put grains into forms to press out the cheese whey, - says Anna Borisova. – But unlike the other sorts of cheese, Roquefort cannot be pressed; you don't put load on it: we just turn this cheese from one side to another several times a day for three days, and whey goes off itself"

Long shelf life

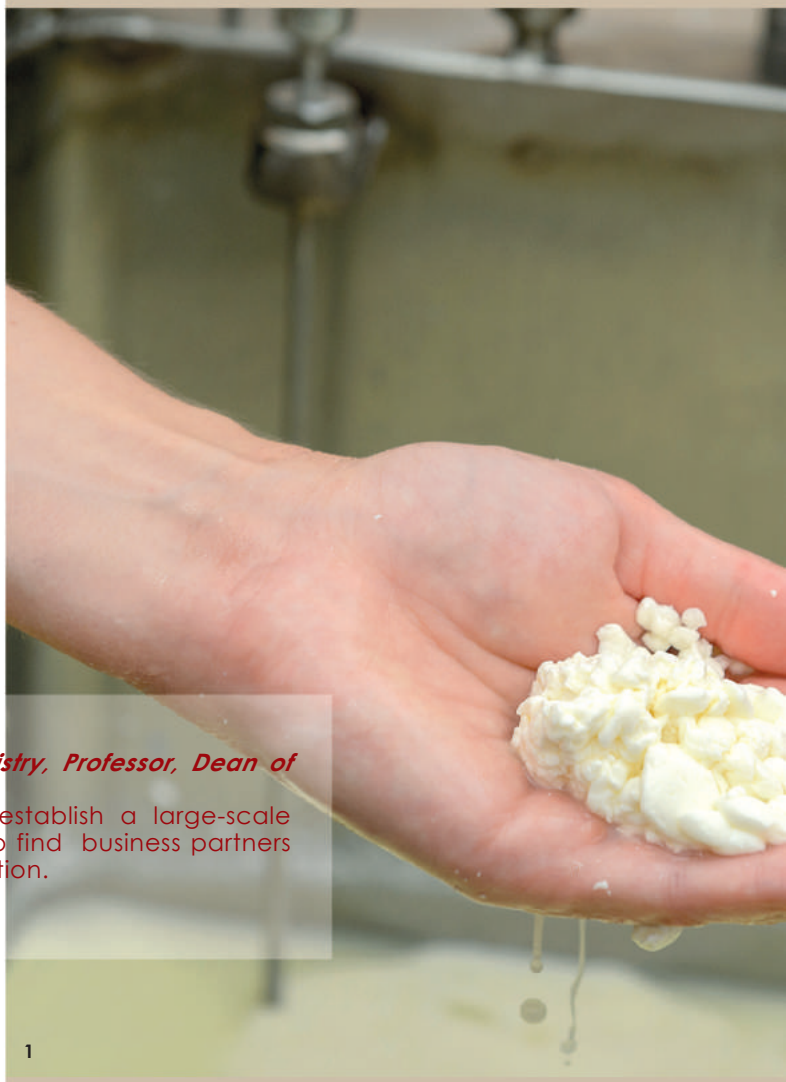
The whole process, from putting milk into bath to pressing of the final product, takes about 4 hours. But it's not the end of the work. Since SSTU cheese-makers add no colorants and preservative agents, during the maturation period (for Roquefort it takes about 3-4 months), on the surface of natural cheese, even if kept in thermostate chamber, the "bad" mould can appear, that is removed once a week by washing the cheese block with pickle solution made of sterilized water, salt and vinegar. With such regular treatment, cheese can be stored for up to twenty years.

Product made colorants- and preservatives-free, keeps its white color for six months. Natural yellowing starts only after half a year – in case, if during the firm cheeses second warm-up, the temperature was high. With this, the membrane gets yellow, but inside cheese remains white. Cheeses that are completely yellow, are likely cooked with using of colorants.

For 9 months, SSTU cheese-makers managed to produce not Roquefort only, but also other sorts of cheese: Suluguni, Russian cheese, Gouda, Mozzarella, Parmesan and Dorblu.

The technology of their production is the same; the different taste of these cheeses depends on milk and ferments used. A lot of things are determined by feed

Vladimir Bakharev, Doctor of Chemistry, Professor, Dean of the Faculty of Food Production:
– It is hardly possible that we will establish a large-scale production but we would be happy to find business partners ready to cooperate with us in this direction.



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1. It is vital not to miss the moment when the cheese grain becomes sticky.

2. After adding the ferment, milk coagulates.

3. Anna Borisova works on cooking cheese with traditional technologies.

4. It is time to put cheese grains into forms.

that is given to cows, in which condition they live, whether they graze or remain in stable all day long. It is proved that the taste of the milk by the Swiss cows grazing on Alpine fields is significantly different from the milk of Russian cows.

Also, while cooking cheese in different locations, different microorganisms are used, under the influence of which different odoriferous compounds are released, and that's why it is no wonder that French and Russian Roquefort significantly differ by taste.

The output of cheese from 50 litres of milk is 5 kilograms in SSTU. Self-cost of 1 kilogram of the product without cost of leaven and ferments is about 300 rubles.

In the nearest plans, the SSTU cheese-makers intend to use natural additives that give cheese a specific taste. In this purpose, husks of grapes and apples can be used to lay around the product.

5

6

5. The whey is a side-product at cheese production.

6. The cheese put in forms will be maturated in the thermastate chamber.

Russia 1. 12.10.2015. Volga Dorblu – a cheese from test-tube, made in SSTU laboratory – will turn into a complete business-project that would surely be a success in terms of import substitution program. In any case, a true chase after the samara mould cheese is beginning.

RIA Novosti. 15.09.2015. To develop different analogues of European cheese, special equipment at the cost of 400k rubles is purchased for the SSTU laboratory. SSTU has also released the first party of Swiss Firm Cheese and Italian Mozzarella. According to the laboratory specialists, in the near future they intend to start the production of Ricotta. Also, the equipment will allow them to produce any analogues of cheese according to the technologies given in scientific literature.

Argumenty i facty. 16.09.2015. For cheese production, a special milk-clotting ferment and standard natural leavens were used, with no additives, preservatives, colorants and vegetable fat. The process of cheese cooking takes about 5 hours, the first membrane of mould fungi appears in about 2 weeks, the cheese maturation period is no less than 4 months.

Novaya gazeta. 22.09.2015. The cheese factory is small, no bigger than an average kitchen. The walls are finished with white tile up to the half, and the second half is painted white. There is a sour smell. In the left corner, the main device is standing – the biofermenter. It is filled with 50 litres of pasteurized milk, than cooled down to the coagulation temperature (the device shows value of 31.8°C). A bacterial leaven is added to the mixture, it is made of pure lactic-acid bacteria and mould cultures, because right now, a mould cheese sort is being cooked – Roquefort kind. The mould was initially taken from French cheese, than specialist learnt to breed it stand-alone.


F. BEILSTEIN
HANDBUCH
DER
ORGANISCHEN CHEMIE
II.
1896
P. P. V.
БИБЛІОТЕКА
ЕСТЕСТВО
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ON BOOKSHELVES

Today the library of Samara State Technical University contains over 1.3 million various documents

By Ksenia MOROZOVA

The scientific library of SSTU is a real labyrinth: 8 storage rooms, 12 reading rooms, 8 lending libraries in five buildings. Today, when hi-tech and broadband internet rule the world of information, SSTU library still contains priceless books that have no electronic equivalents. Here modern service standards are combined with the traditional steady atmosphere of university book depositary, where engineers of a new generation acquire the knowledge accumulated by their predecessors.

In the beginning

The huge SSTU library is nearly the biggest collection of scientific and engineering books and journals in our region. Its story began on the 3rd of May 1934. The library was formed on the basis of Middle-Volga Industrial Institute. By 1940 there were about 85,000 copies of various books and journals there. Among them, according to information provided by the institute newspaper called 'Personnel', were over 500 foreign books and about 40 foreign journals. Librarians used to arrange exhibitions of rare books and make reviews of the Soviet and foreign periodicals. The library also contained scientific works written by the institute professors.

Hazardous to health

In 20th century the library didn't have its own building so it was situated in the SSTU building 1 where there was

not enough space for it. Shelves were not enough to store all books so the librarians had to build 'towers' of books between them. The librarians even developed their own method of construction. They put books one on one thus building a well-like structure.

"The book storage was awful and didn't meet any fire safety requirements," **Marina Lukashova**, head of book collection department, recalls with sorrow. "Once the library was sealed and we were not allowed to use it. So we had nothing to do but 'deconstruct' our 'towers' and write-off the books. We simply had to throw away many of those books."

Once the president of Kuibyshev Industrial Institute asked Mr. Grodsky to come to his office but the mathematician made him wait. His colleagues were amazed: "Why don't you hurry?". The Professor said with dignity: "Nickolay II himself waited for me, and a president will too."

100 kilograms per librarian

The university library moved to a new place in 2003; that process turned out to be not only large-scale but also very hard. Literally. Books were transported by 'live' conveyor, from hand to hands. Line of students and lecturers stretched from the building 1 to the second floor of a new library building. Sometimes the librarians had to stay in this conveyor up to eight hours a day.

While the librarians were transporting the collection of dissertation works (it took a month), they decided to weigh the papers. It turned out that there were up to 100 kg of scientific works per librarian a day.

In 2015 "Table dictionary for references in all areas of knowledge" by F. Toll kept in the SSTU library celebrated its 151st birthday.

The collection of rare book moved around the university about five times. Initially it was situated in the basement of the building 7 but because of severe floods that damaged part of collection it was decided to move to another place. Today rare books – the oldest of them is dated 1864 – are stored in the main building of the library.

That very Grodsky

Unique books with light brown cover and bold handwriting 'G.D. Grodsky' on them are especially noticeable in the storage of rare books. These rare book artifacts are able to entirely reconstitute the image of the major Russian mathematician whose life became closely connected with Samara State Technical University.

Georgy Grodsky was born on the 19th of June 1871 in Moscow. As he came from a military family, he followed in his father's footsteps.

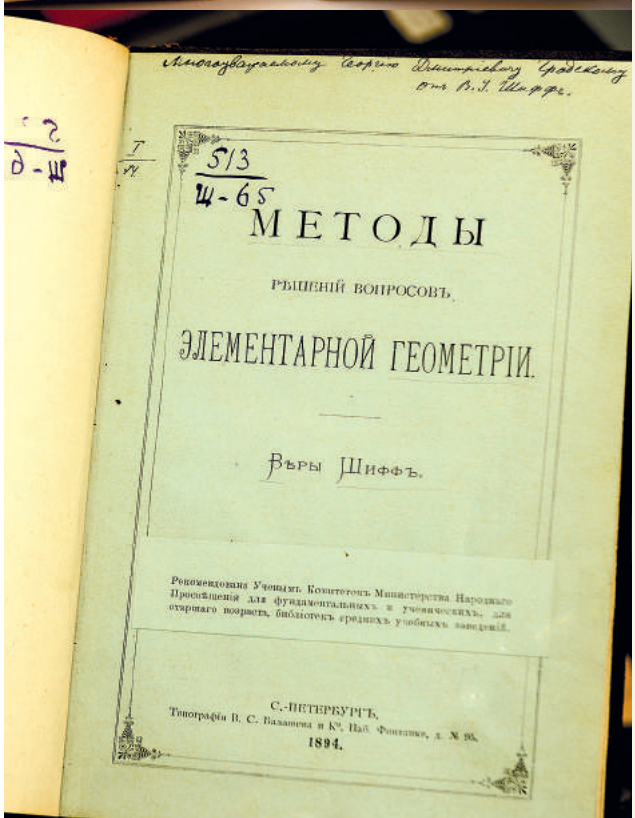
After graduating from Tbilisi cadet corps with best grades Georgy entered the famous Mikhailovsky artillery school where his almost half-a-century-long military career started. "In 1892 I was the best to complete the 3-year education course of Mikhailovsky artillery school and my name was carved on the marble plate of honor. I won the first prize for excellent studies and golden watch for artillery gun practice competition and spadroon fencing," that what Grodsky wrote in his autobiography.

In five years the young officer graduated from Mikhailovsky artillery academy with silver medal and in December 1913 he became major general.

Georgy Grodsky was gifted not only in the military arts. Ever since he was young he was genuinely interested in mathematics. He saw beauty in cold numbers and dry formulas.

Grodsky started his career as a mathematician after he had defended the dissertation titled "Theory of harmonic function and its application to resiliency theory" in 1902. In 1909 the professor wrote another work called 'Theory and design of modern gun carriages'.

After revolution events in 1917 Grodsky served in the Soviet Army and worked as a Professor in Tula Public Education School, Leningrad Machine-Building Institute and Leningrad Institute of High-Precision Mechanics and Geodesy. In March 1935 he and his family were sent to Kuibyshev where he lectured at Industrial Institute and headed the Chair of Advanced Mathematics until his death. Today his



scientific heritage consists of more than 50 articles, monographs and inventions.

Book rarities

The pearl in the library collection of rarities is handwritten book called 'Theory of numbers' by the famous professor of mathematics at the University of St. Petersburg **Y. Sokhotsky**; he wrote it in 1886. Its yellowed pages are covered with neat lines of sophisticated mathematical formulas carefully written with coal-black ink. This book is one of the most mature works of this Russian-born Polish mathematician. (Sokhotsky was one of the first scientists to prove the well-known among mathematicians theorem about behavior of analytic function in essential special point vicinity – the Sokhotsky-Weierstrass theorem).

There are some other valuable items among Grodsky' books which are stored in SSTU library. For example, a book called 'Theory of determinants and theory of forms' (1877) written by **M. Vashenko-Zakharcheko** who was an advocate of non-Euclidean geometry, collection of best works by French mathematicians **C. Briot** and **T. Bouquet** called 'Analytic geometry' (1868), a textbook 'Methods of solving problems of elementary geometry' (1894) by V. Schiff. There is a presentation inscription on the flyleaf of the latter saying 'To highly distinguished Georgy Dmitrievich from V. Schiff'; it shows that the two Russian scientists were on friendly terms with each other.

Something to read

"We also have 'Brockhaus and Ephron Encyclopedia', both old and new editions," says **Nina Bronevskaya**, acting director of the SSTU scientific and engineering library. "It's not something that you can find in every library."

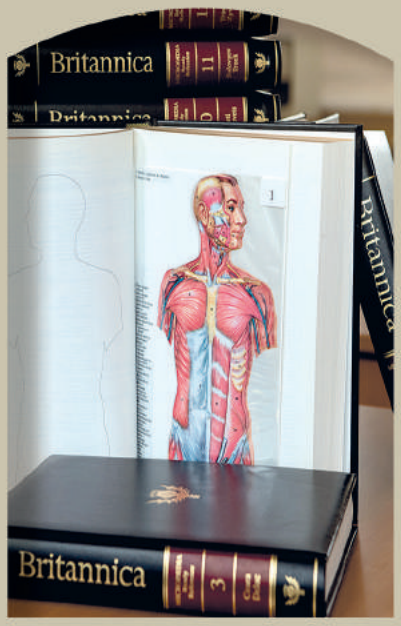
This encyclopedia is the biggest pre-Revolution Russian encyclopedia (86 volumes). Being published from 1890 to 1907, it gained prominence because of variety and depth of material. This encyclopedia even anticipated the English 'Britannica' to certain extent; the latter can be found in the SSTU library too.

There is 'Oil industry of Azerbaijan' magazine published in 19th century and first issue of N. Geisler's 'Electricity' journal published in 1913.

"Today students prefer other journals," **Vera Lisitsyina**, head of foreign literature room, explains. "For example, 'Journal of the American Chemical Society' is very popular among students and lecturers of the Chemical-Technological department."

Samara State Technical University library

SCIENTIFIC AND ENGINEERING LIBRARY



To readers

Scientific and engineering library of Samara State Technical University founded in 1930's now contains about 1 300 000 books and journals; among them there are some rare books that cannot be found in any other library. At readers' services are: 12 reading rooms, 8 lending libraries, assistance of qualified librarians. Total area of the library is 5000 square meters.

Address:

- Samara: 244 Molodogvardeyskaya St.; 18 Pervomaiskaya St. (SSTU, building 1); 141 Galaktionovskaya St. (SSTU, building 6); 244 Molodogvardeiskaya St. (SSTU, building 8); 1 Tsiolkovskogo St. (SSTU, building 10); 34a Lukachyova St. (student hostel);
- Syzran – 45 Sovetskaya St.

RUSSIAN ANALOGUES IN HEATING

Russian products can compete with European analogues in the area of small power systems

By Tatiana VOROBYOVA

The term "import substitution" came into common usage after the introduction of the economic sanctions of the Western countries against Russia. Our scientists and experts have already proposed for several decades to replace expensive imported equipment with cheaper and sufficiently reliable domestic analogues. Developments in this area have been conducted at the department of "Heat Power Engineering" of Samara State Technical University in the framework of the contract work. According to the Head of the Department, professor Anatoly Schelokov, Russia has enough of its own competitive products at the market of small power systems and it is quite possible to avoid foreign products.

▲ Professor Schelokov offers solutions for import substitution problems.

Atom has not solved the problems

Small power systems are not well developed in our country. In the Soviet period the strategic direction was to build a dozen of nuclear power plants producing the cheapest energy and due to this to satisfy the energy needs of the country, - said Professor Schelokov. It was decided not to develop a decentralized heating. Boiler stations were shut down, the heat energy consumers were connected to the central network. The length of Russian pipes of heating systems is six times longer than the length of the equator, it is 260 thousand kilometers. Nowadays, 40% of the pipes are worn out, they must be replaced, hence we have a high accident rate. Large power plants also require huge capital investments and they have the long-term payback time. After the transition to the private sector most owners stopped upgrading the equipment at the heat power plants and it started to be out of action.

Liquidation of small boiler stations resulted in the centralization of heat supply, therefore in the nineties many companies faced all sorts of difficulties. For example, Press and Stamping Plant OJSC KAMAZ could not provide the appropriate quality of painting of the truck bodies. The reason was that the hot water from the TPP came to the factory heating system with low temperature and didn't provide rapid drying. The management of the enterprise appealed for help to the department of "Heat Power Engineering" of Samara State Technical University, they have had experience of implementing the system of decentralized process of heat painting in the company Electroshield Samara Group. KAMAZ was transferred to the autonomous decentralized heating within a year. Home equipment was installed instead of the French one which allowed them to produce products of good quality. All costs were paid back within six months.

European countries chose another way: funds were invested in the plants both large and small. Gradually, the tendency of heat supply decentralization has started to emerge in the energy sector in Russia. Many power plants based on the principle of cogeneration appeared. This means that the energy source (gas turbine or gas-piston engines) has a limited capacity.

Flue gas having a high temperature is supplied to the heat recovery boiler which produces steam going to a steam turbine, and low-grade heat is used for hot water supply. Necessary equipment for small power systems is brought mainly from abroad, and it costs several times more expensive than home equipment. This means that the import substitution problem should be solved as soon as possible.

> ***Anatoly Schelokov, Professor, Head of the Industrial Thermal Power Engineering Department of Samara State Technical University said***: "There is much to learn from foreigners in the field of microelectronics. But why buy imported mechanical products? Russia is a great country and there are a lot of resources and qualified specialists able to produce these products themselves.

For Russian conditions

Professor Schelokov showed a list titled "Highly efficient developments of the Department of Heat Power Engineering" including the range of installations developed by staff of the Department for different companies such as Electroshield Samara Group , TsSKB - Progress and many other companies in our region, as well as industrial enterprises in Tatarstan, Orenburg, Chelyabinsk, Moscow, Sverdlovsk and Ivanovo regions, the Yamalo-Nenets Autonomous District, Udmurtia and Bashkortostan.

"We have carried out researches and developed a variety of devices for oil and gas companies," - said professor Schelokov. "Oil companies, for example, have been actively using steam boilers of our design for enhanced oil recovery. Our developments are used for

supporting living conditions of company employees. The fact is that field camps are constantly moving, so the heating sources must also be moved. We have developed two mobile modular automated boilers heating these camps. They have very simple constructions designed for the conditions in Russia and have been already operating for five years without any problems in the Far North environment."

"Special attention should be paid to the fact that imported equipment generally requires regular replacement of spare parts which are very expensive. For our equipment only one spare part is needed", - explained professor Schelokov. – "For example, Electroshield Samara Group has a shop with 17 processing baths where details are treated with special solutions before painting. The process involves 17 operating heating elements, and one more is in reserve. And if any part is covered with hard deposits, it loses its ability to heat the solution well. As the mechanical technicians can replace it for 30 minutes, the solution temperature will drop only by 1-2 degrees which will not affect the technological process. Besides, the same element can be used again after cleaning."

A cave instead of a flat

It is known that 40% of natural gas is consumed in the housing and communal services because we all need heat and hot water. Therefore, water and steam boilers developed at the department are widely popular. By the way, most of the developments are protected by patents of the Russian Federation. The patentee is Samara State Technical University.

"Twenty years ago we started the certification of power engineering products, "- says Anatoly Schelokov. "At the time of the USSR our department developed gas consuming appliances: water heaters, heating boilers, burners, radiant tubes for heat treatment furnaces of engineering plants. Before launching the products it was necessary to pass state tests and get the certificates of Russian Technical Inspection. The products must meet requirements for safety and ergonomics. The only testing center providing all the state tests was in Kamensk-Shakhtinsk in the Rostov region. We knew the process of state testing very well and opened a testing center at the Department of Industrial Thermal Power Engineering certified by the Russian Technical Inspection and Gosstandart of Russia."

When the experts of Novosergievsk mechanical plant brought the boiler to our center, we explained them that it wouldn't pass the certification tests. It was designed for three types of fuel (natural gas, diesel fuel and firewood) but the volume of the furnace was the same. Furthermore, there was no certainty about the compliance with national emission standards. We proposed to test the boiler providing help in the further development of the product. Tests showed that the efficiency of the boiler was only 60% instead of the required 84%, and the emissions exceeded the standards by several times.

As a result the boiler was improved, all necessary documents were developed, and the new product appeared on the Russian market. Novosergievsk mechanical plant supplied Moscow suburbs with the gas fueled boilers for some period of time.

Also, the staff of the Department of Industrial Thermal Power Engineering offered the plant a design of wood fuel boilers for heating of individual buildings. Its principle is simple: after the evening loading and firing of firewood the boiler is transferred to the gasification mode followed by afterburning of the gaseous products that provides long-term combustion process. The calculated amount of fuel is enough to ensure the hot water until morning, and slow cooling of the heating system provides conservation of the heat in the building.

"Once I told the students that because of the constant growth in the cost of energy resources we would see in the future the ads about changing the comfortable apartments in the centre of Moscow to the cave, preferably in the woodland ,"-noticed professor Schelokov. "In recent years, the number of people inhabiting rural areas has grown, so the boilers are in great demand."

We are ready to produce

According to Anatoly Schelokov, the boilers of foreign production for different applications are poorly adapted to Russian conditions.

Although the imported equipment is three to four times more expensive than the home ones, it is still preferred, - complained Anatoly Schelokov. - But our boilers have a lot of advantages including a simple design and high maintainability. And there is one more very important thing – they do not require chemical water treatment, tap water (drinking water quality) is suitable.

Later professor Schelokov had an idea to create a mobile boiler-house to provide the emergency heating for important objects. The engineers of Novosergievsk mechanical plant designed it but there was a big disadvantage: it was designed for operation using antifreeze fluid instead of tap water. Today, the plant produces block-modular boilers which cost much cheaper than the imported ones. The cost of similar equipment for emergency heating of the same capacity with imported equipment requiring high-quality diesel fuel and chemical water treatment is several times higher than the home models.

On the roof of the house

One of the latest trends in decentralized heating is installation of boilers on the roofs of buildings. It has a number of advantages: a significant increase in energy efficiency and minimal heat loss due to the lack of heating pipelines.

Laying underground heating pipes and replacing pipelines in poor condition cost billions of rubles.

The staff of the Department of Industrial Thermal Power Engineering started to develop roof boiler-houses at the same time with foreign analogues. The first experience of installing such kind of a boiler-house on the roof of Sberbank's building in Oktyabrsky area was not successful.

Roof boiler-house was placed directly over the office of the General Manager. But soon the boiler was removed because of the loud noise. But another boiler installed on the roof of a 12-storey residential building in Enthusiast street in Samara is still in operation. It was produced at Electroshield Samara Group. It has been in operation for 12 years. Only the last year there was a problem with decreasing the water temperature. Gas heater inspection showed that there were hard deposits on its surface. After replacing the heating element the roof boiler started to operate in normal mode.

Similar developments of our department are introduced in the company "ROSSKAT" in Neftegorsk (they were repaid after 4 months).

"At the end of each heating season our representatives are invited to inspect the boiler equipment," - said Anatoly Schelokov. "They make some recommendations for a new heating season. The boilers with simple automation can operate without the staff."

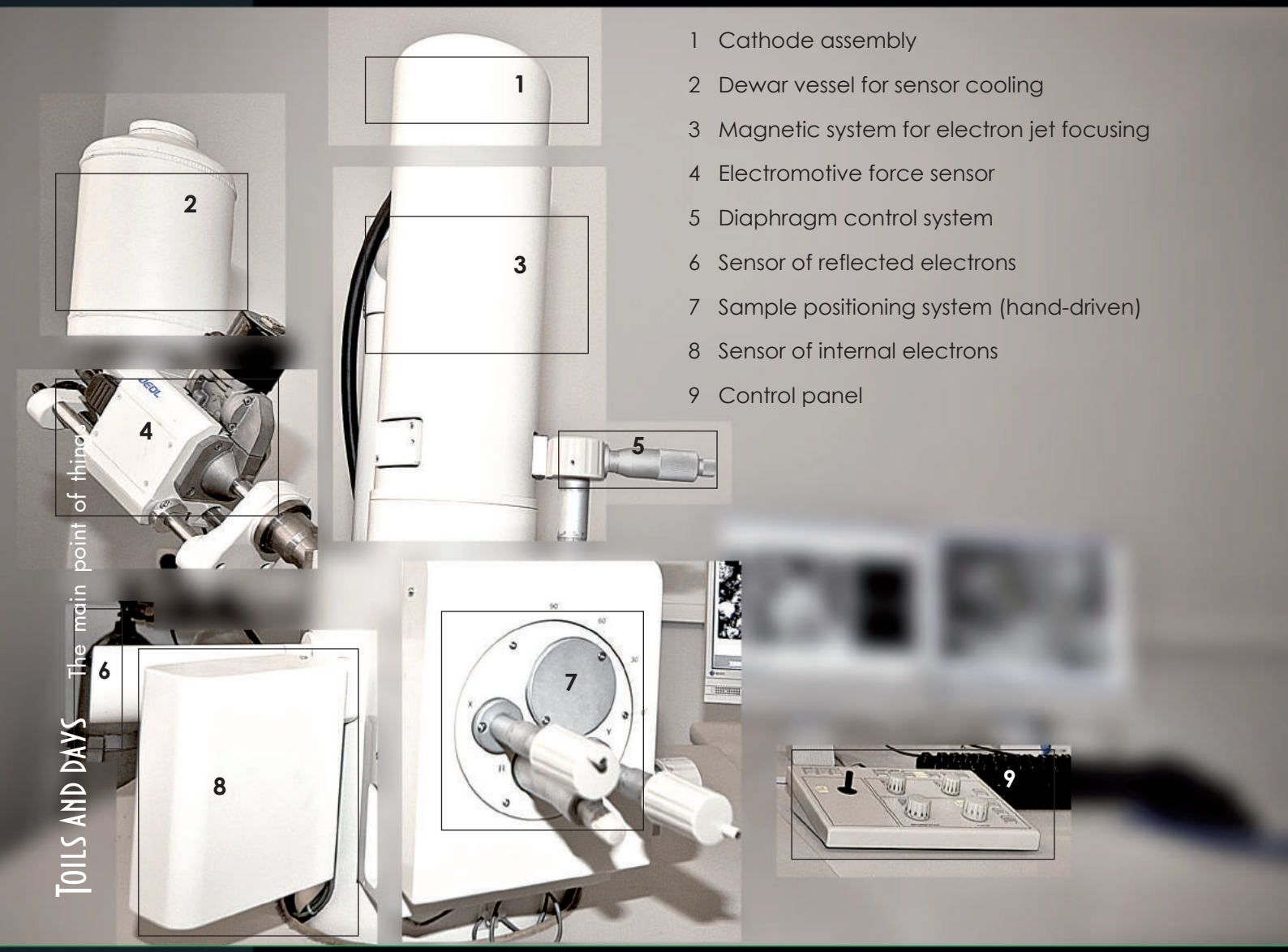
Better than in Germany

Professor Schelokov is an inventor by vocation. In the Soviet period he had 29 copyright certificates. Now he has 17 new patents, and almost all of the developments are implemented in various sectors of the economy.

One of his developments, a gas-burning device, was tested in Kamensk-Shachtinsk in 1988. The results were so good that testing engineers decided that the devices showed wrong values because of the "bad" reagents. Arriving in Kuibyshev, Anatoly Schelokov and his colleagues recalculated the figures using "bad" reagents, the results were very good. For example, according to GOST 10687-88 the rate of nitrogen oxide emissions in the environment should not be more than 250 mg / m^3. The value of the tested sample didn't exceed 75 mg / m^3.

"Now, German burners are popular in Russia. They are environmentally friendly but European manufacturers haven't reached our level: the rate of nitrogen oxide emissions of our product is 70 mg / m3, their value is 80 mg / m3. Besides, the value of CO in combustion products of German devices is 60 mg / m3. Our equipment doesn't have any harmful admixtures. Therefore, we are proud of our achievements and believe that our equipment is not only as good as the equivalent European-made equipment in terms of quality, but has the best price-quality ratio, "- said Anatoly Schelokov.

Samara State Technical University is ready to take part in the process of import substitution. Professor Schelokov said: "Our department offers its assistance and cooperation to all manufacturers of thermal power and thermal technological equipment. We are ready to process the documentation on the products to optimize the manufacturing. We have had years of experience in scientific support of the developments."



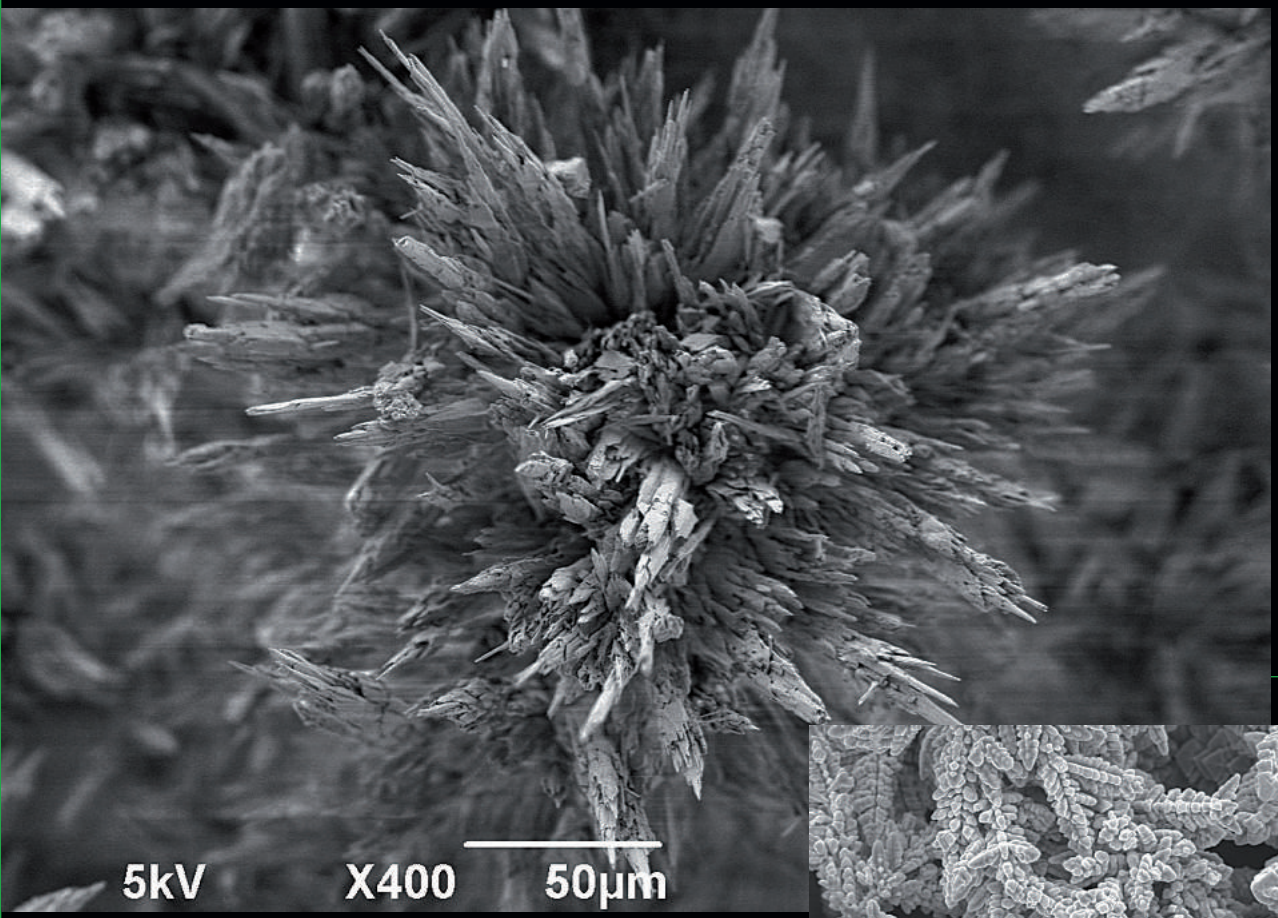
1 Cathode assembly
2 Dewar vessel for sensor cooling
3 Magnetic system for electron jet focusing
4 Electromotive force sensor
5 Diaphragm control system
6 Sensor of reflected electrons
7 Sample positioning system (hand-driven)
8 Sensor of internal electrons
9 Control panel

IN THE SMALLEST DETAILS

You can see everything in the smallest details using the unique equipment at Samara State Technical University

By Eugenia NOVIKOVA

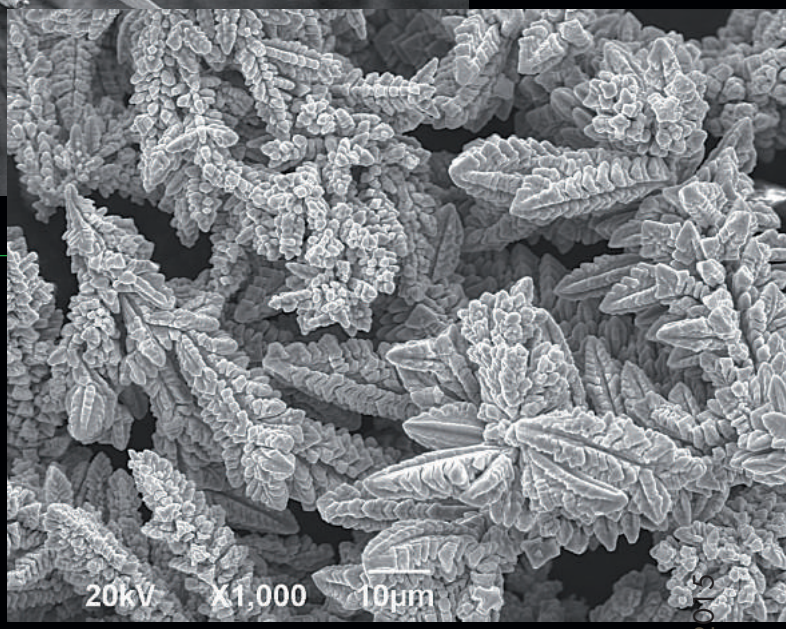
It's not easy for an ordinary person to understand what XRDEPM means, even if they look at these letters through the microscope. Meanwhile, the laboratory of X-ray diffractometry, electronic and probe microscopy (XRDEPM) has been functioning at Samara State Technical University for five years already. Hundreds of students and postgraduates use it, over 20 companies cooperate with it including major industrial enterprises and scientific centers: Samara ball-bearing plant, 'Alcoa' plant manufacturing aluminum semi-finished products, Samara Research, Development and Project Institute of Oil-production, Chamber of Commerce and Industry of Samara region.



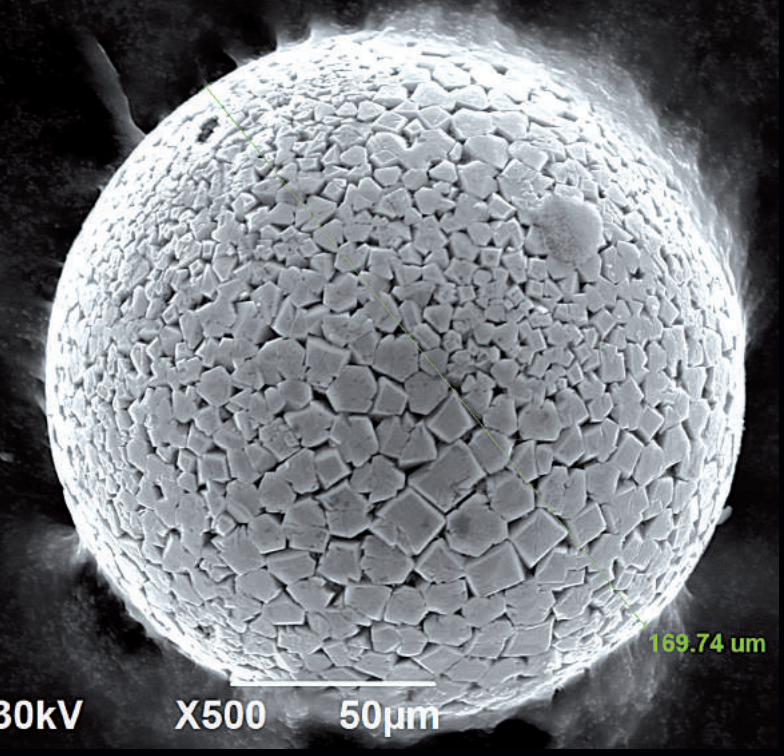
▲ Malachite (400x zoom)

"It was the president of SSTU Vladimir Kalashnikov who came up with the idea of setting up a laboratory as a separate subdivision. He decided to count on young and prospective employees and helped to arrange necessary conditions for their work," Sergey Stetsenko, head of the subdivision, says.

The heart of the laboratory is up-to-date equipment that has no equivalent either in Samara region nor in Russia. Orders for services of XRDEPM come from all parts of the country, for example from Penza, St. Petersburg and Moscow.



▲ Copper powder (1000x zoom)

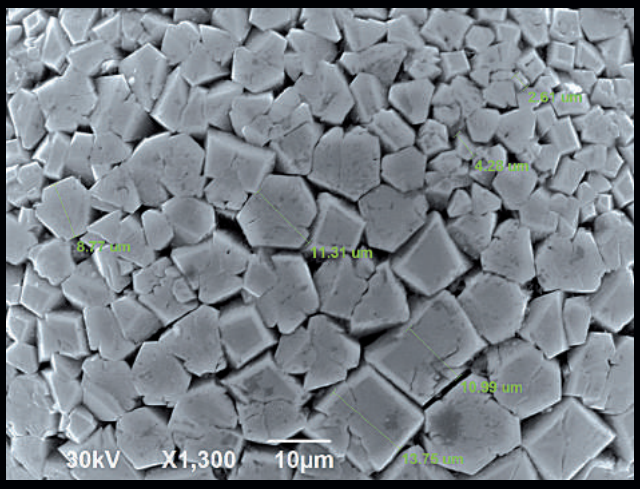


Microspherules

Formations like this are often found in all parts of the planet, in various geological conditions and rocks.

If we represent the laboratory as a small techno-kingdom, then the Japanese scanning electron microscope JEOL-6390A will definitely be the king. Its capabilities are almost unlimited indeed, this device allows one to see the surface structure of every solid matter in detail; it's also able to define the percentage of elements from boron to uranium. Through this microscope we can look deep inside various materials: metals and alloys, diverse types of ceramic, minerals, polymers, biological tissues – everything that you can put into this device.

"In order to arouse interest in science in young people, we upload pictures of common things taken by this

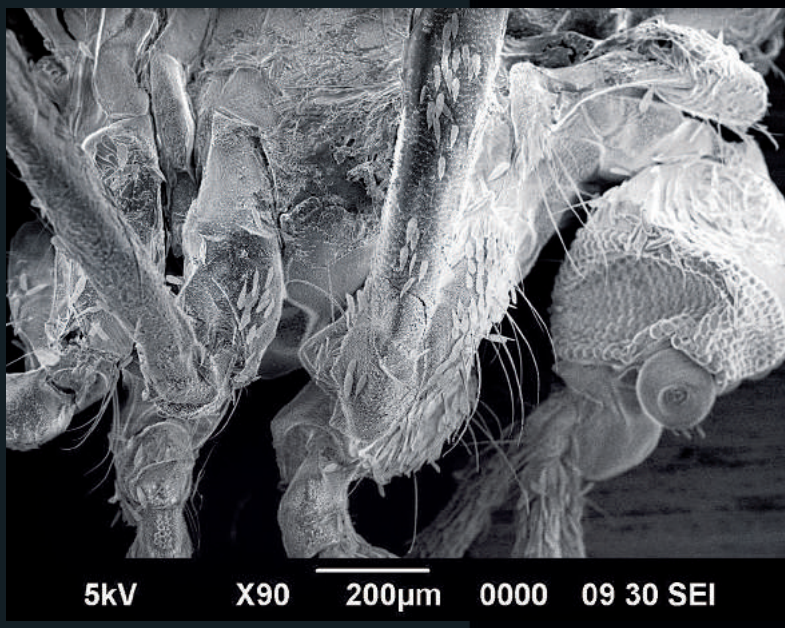


Powder X-ray diffractometer ARL X'TRA

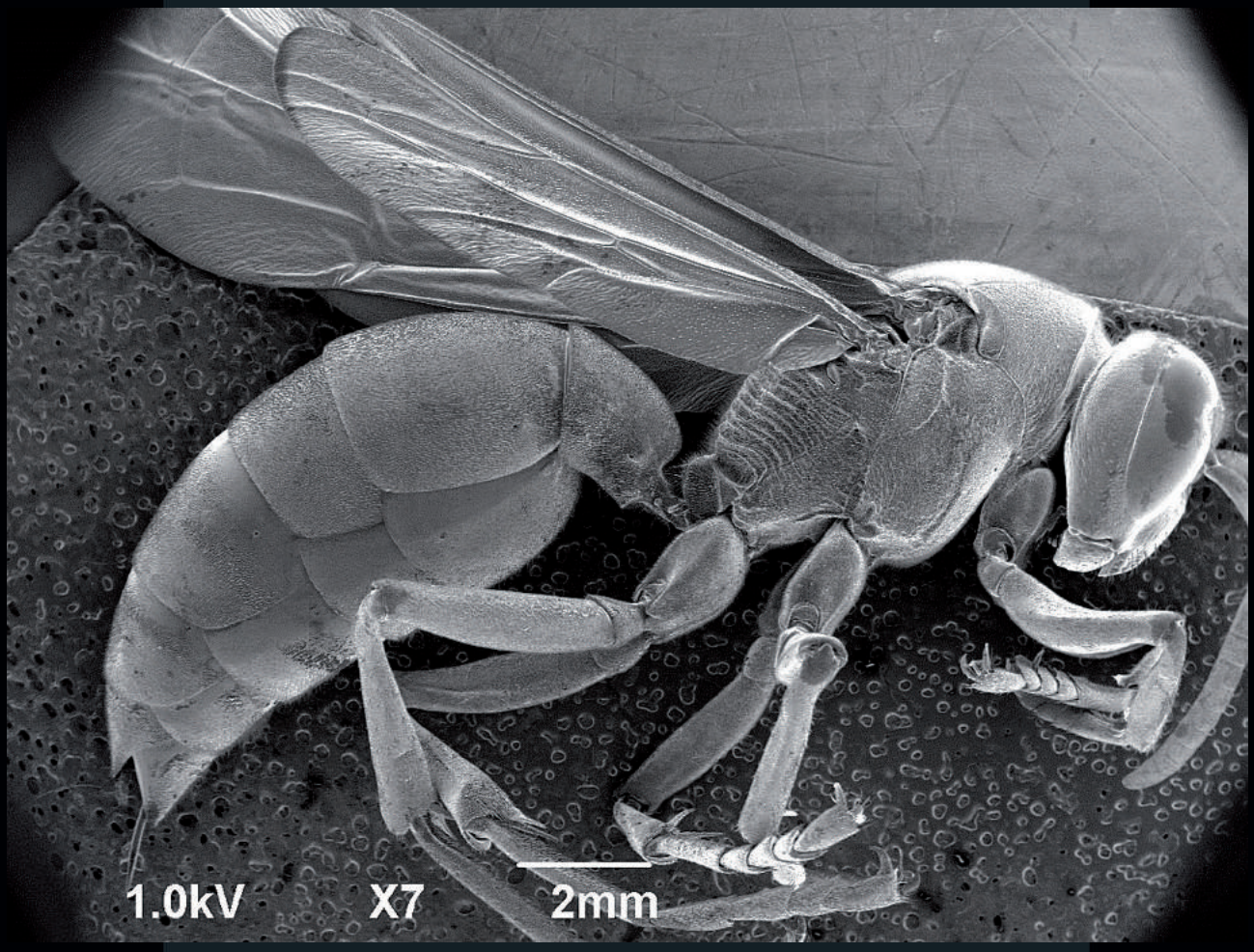
microscope into social networks," Sergey says. "Usually people are interested in learning something new about things the see every day: insects, plants, a water drop or, for example, a pencil tip look rather fascinating when magnified."

Magnifying range of JEOL-6390A is from 5 to 300 times. Such technical properties allow a researcher to analyze chemical composition of a sample by a point chosen on its surface or by series of points, by area or set-length section. Distribution of elements throughout the area of microsection (specially prepared surface of a sample, polished and, if necessary, treated with reagents) is also of interest. Such data is particularly important when studying multi-layered material and coatings put by spraying, deposition or some other method.

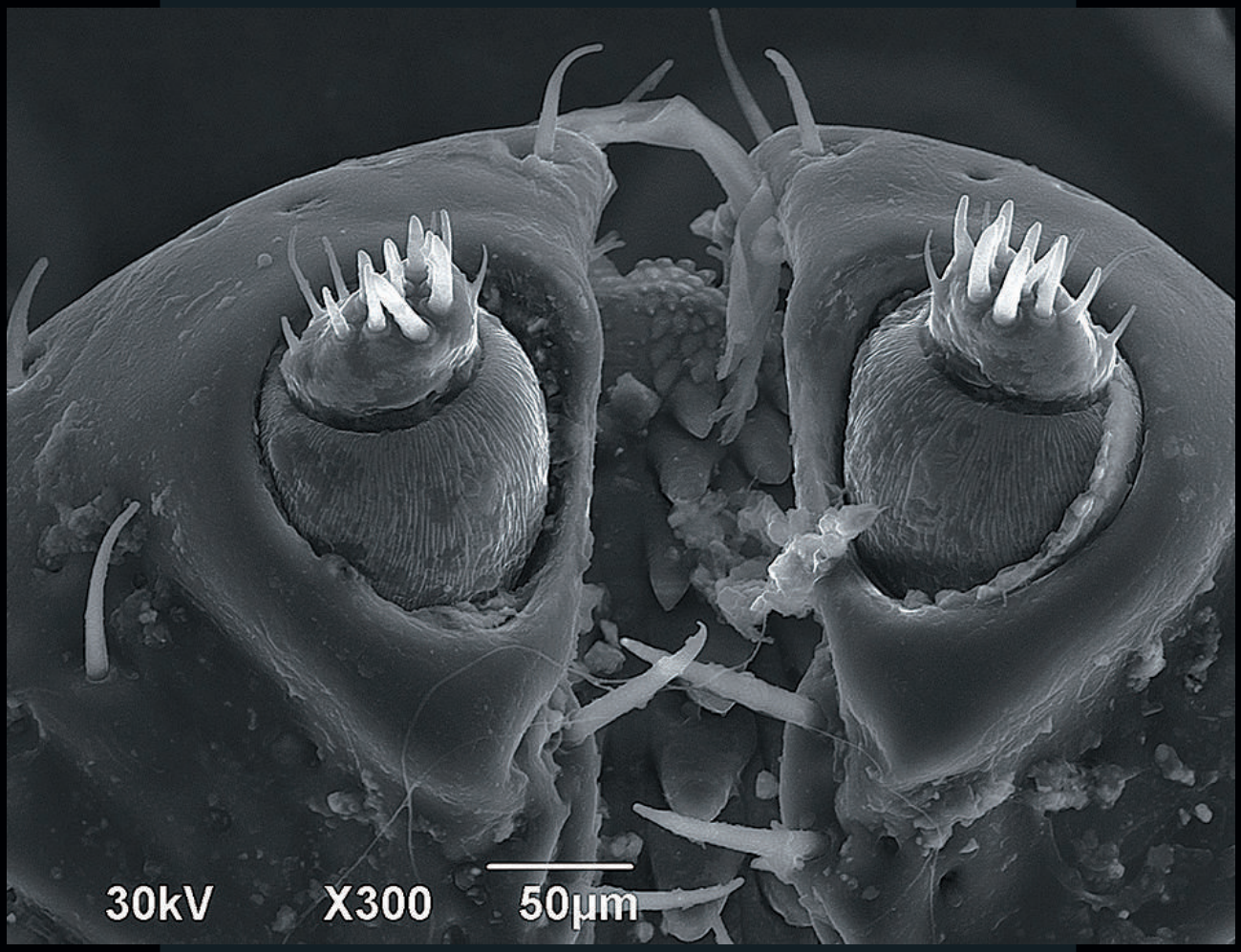
On the basis of microscopic research scientists obtain information about structure of a fracture, for example, of a steel or polyethylene sample. After that, some changes can be made in current scientific work or some explanations for structure disintegration can be given.



▲ Mosquito (90x zoom)



▲ Wasp (7x zoom)



▲ Mite's eyes (300x zoom)

Another impressive device in the laboratory is Swiss powder X-ray diffractometer ARL X'TRA. According to Stetsenko's words, this device together with microscope – to be more precise, with electromotive force attachment – is really essential for scientific research. This device utilized the method of diffraction reflection of X-rays from crystal lattice of a sample. Every crystalline material has its own unique set of reflections and interplanar spacings. Phase composition of a material can be identified by comparing experimentally measured interplanar spacings with reference quantities from the database. The length of X-ray and shooting angles are enough for quality phase analysis.

Diffractometer looks like a giant box that occupies about one-fourth of the laboratory area and a small room in the basement where its cooling system is installed.

Finally, American nanoindenter Agilent G200 measures hardness and elastic modulus of a sample. This device helps to identify the composition of a film and substrate in thin-film structures without preparing crosscut microsection and treating the surface with reagents. Nanoindenter is able to define adhesion strength of film coating (scratch test), estimate contact, fatigue and abrasive wear resistance. The 'nano' prefix means that this device is used for examining nanostructured coatings. Agilent G200 is equipped with an optical microscope with interchangeable lens which can zoom up to 1000 times. It allows the setting of highly precise coordinates of an examination point or area and visualize them after measuring.

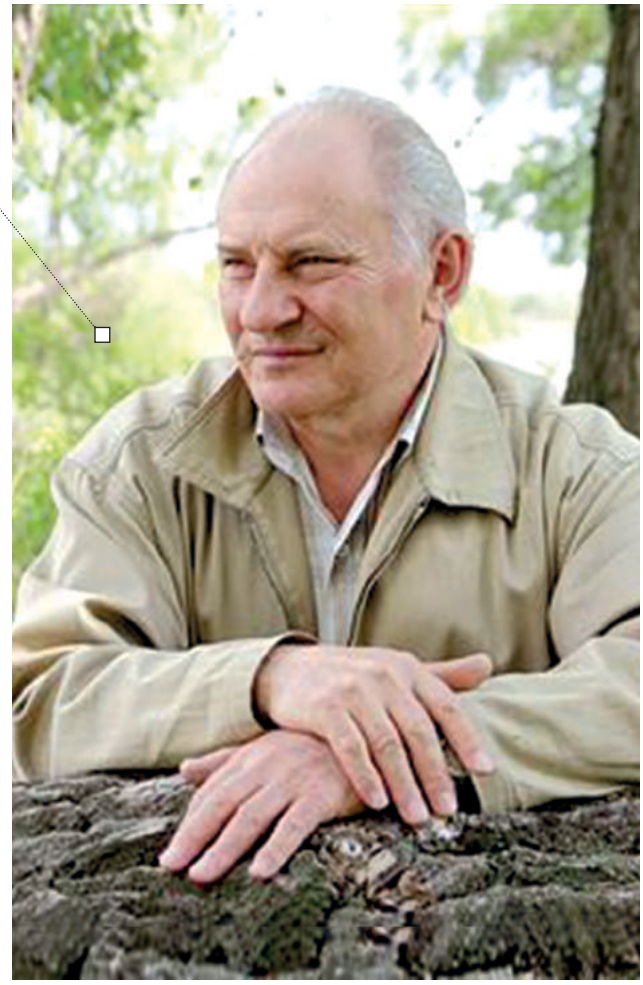
SEARCHING FOR "MADONNA OF UTYOVKA"

All his life a scientist from Samara State Technical University has been searching for icons of a gifted painter

By Svetlana EREMENKO

"This icon was painted on the 2nd of July 1885 in the village of Utyovka by Grigory Zhuravlyov, a peasant. As he has no arms and no legs he painted it holding the brush in his teeth." That is what was written on the icon found in the village of Purachin near Tuzla (former Yugoslavia) in 1963 by the Serbian painting historian Zdravko Kaimakovich who was making a record of cultural monuments of Serbian Eastern Church. He sent the request to the USSR State Archive and it confirmed that Grigory Zhuravlyov was born in Samara region.

Alexander Malinovsky, Doctor of Engineering Science and Professor at SSTU, devoted his life to the search for icons of this painter from Utyovka. The 5th edition of his book entitled 'A Joyous Encounter' was published not so long ago. Each page of this book about Zhuravlyov is the result of huge work done in the capital and local archives in order to write the biography of this painter. Malinovsky has collected information about nearly 100 of **Zhuravlyov**'s icons.



Home and hearth

It all started with stories that Malinovsky's grandfather Ivan Malinovsky told about Zhuravlyov.

"My grandfather knew him when Zhuravlyov was alive. I was 12 years old then and I was astonished by the stories about the unusual painter," Alexander Malinovsky says. "I realized how strong-minded that man was – he worked and created things instead of begging on the street. Rather unusual."

In the early 1970's only few old residents of Utyovka knew that inside painting of the local church (used as granary) was done by Grigory Zhuravlyov who lived nearby and is said to be buried here, on the church territory.

Alexander MALINOVSKY was born in 1944 in the village of Utyovka in Neftegorsky district of the Kuibyishev region. Malinovsky graduated from the chemical-technological department of Samara State Technical University. He made his way through from a worker to the head of the major petrochemical enterprises. He is Doctor of Engineering Science, Professor at SSTU. Malinovsky is an Honored inventor and engineer of Russia, academician of Russian Engineering Academy. He is a member of Russian Writers Union. Malinovsky wrote 20 books, in 2015 he completed the typescript of the next book entitled 'Petrochemistry in Samara region: years, people, production' about establishment and development of chemistry and petrochemistry in our region starting from Peter the Great period. Malinovsky won four all-Russian literary prizes.

Initially Malinovsky wasn't going to write a book about Zhuravlyov and he was searching for information about Zhuravlyov for some other reasons. His intentions were simple: he wanted to interview people of Utyovka who knew or remembered something about this unusual painter who was armless and legless from birth, visit the church which he painted, talk to parishioners and thus gather the information and put down particular names and events. It was important for him to find and save facts before they disappear as people die.

Malinovsky started his work in 1960's when he was a student.

"People around looked at me with caution: it was time of militant atheism. Even the museums hid the icons deep in their storerooms. I put on tape the story told by another man (second after my grandfather) who new Zhuravlyov. At that period I managed to find the only photograph of Zhuravlyov – there were him, his brother and his icon called 'Milkgiver' on it."

Malinovsky found out that Zhuravlyov was famous around the region – and even in the capital of Russia – for his gift of painting.

There is a legend that the painter from Utyovka was invited by the emperor **Nickolay II** to the palace to paint the portrait of the royal family. On his way back from St. Petersburg Grigory was caught by the circus people. They took him around Russia showing him as a freak. Zhuravlyov only just managed to escape.

Nickolay II gave Zhuravlyov harness, a tarantas, a horse and life pension – 25 rubles per month. The governor of Samara also paid attention to the painter. Fellow villagers were fond of Zhuravlyov too.

'A Joyous Encounter' was inspired by the following occasion. During one of his visits to Utyovka in the mid-1980's Alexander Malinovsky noticed that there were no cross on the top of the local Holy Trinity church. The story was the following: villagers asked the local authorities to open the church but the result was exactly opposite - authorities removed the cross. No cross – no church.

Local atheists hoped the whole case would die away.

"I wrote the book called 'Home and hearth' in order to stop the further destruction and draw public attention to this situation," says Malinovsky. "And people began to reconstruct the church by themselves. Being impressed and pleased by the changes brought into our life I published the second edition of the book called 'A Joyous Encounter'. There was description of twelve more icons of this painter in it."

▲ There is only one photograph of Grigory Zhuravlyov.

Godsent

The search for each icon is some kind of investigation based on meeting people and results of archive work. Since the new edition of 'A Joyous Encounter' has been published, the list of the icons found is becoming longer and the search area is getting wider.

In 1992 Malinovsky received a letter from the monastery of the Trinity and St. Sergius – it still possesses an icon called 'Holy Leo, the Pope of Rome' in its church archeological room. In 1999 a verger of one of the Russian churches in Kazakhstan gave the icon called 'Cyril and Methodius' to the Samara eparchial museum. In 2005 the copy of the certificate of painter's death was found – dated the 15th of February 1916.

Sometimes these findings look occasional but Alexander Malinovsky

thinks that they are godsent. For example, two years ago he decided to write a book about **Alexander Sverbeev**, the governor of Samara. As he was looking through the diaries of the tenth head of Samara province government in the Russian State Archive of Literature and Art, he suddenly came upon four letters of Grigory Zhuravlyov. In one of them – dated December 1880 – the painter wrote that his father would bring the governor seven icons ordered by him. In another letter dated 1884 he asked crown prince Nikolay to accept the icon called 'St. Nicolas the Miracle-Worker' painted especially for him.

Malinovsky thinks that this discovery is very important: "That's how we got detailed information about some of his works. What's more, most of them were painted on gold. We found one of these icons not long time ago."

It's a case of the icon that was found in the Hermitage Museum storage rooms. There is a writing on the back of it saying "From the Crown prince's archives"; none of the museum employees attached importance to it. They noticed that there was something special about the way the saint's face was painted: it was anxious. Zhuravlyov didn't follow the tradition of drawing the saints' faces like 'clear water' – without facial expression and strong emotions.

"Why did it happen? I was thinking about it for a long time. The situation in Russia was uneasy. **Alexander II** had been killed. Nickolay Romanov's diaries say that he was afraid of becoming a tsar. That firmness and self-sacrifice required to serve the people, all these qualities associated with St. Nicolas the Miracle-Worker, Nickolay needed them so much! I wonder if a 26-year-old painter from a distant Volga village was thinking about it. Or was he worried only about creating a proper icon of a saint, Crown prince's namesake? First option, I'm sure."

▲ Icons drawn in pencil impress by their spiritual content and fine lines no less than painted icons.

So far, Malinovsky has managed to locate about 100 icons by Grigory Zhuravlyov. The most recent icons found are 'The Chosen Saints' (Religion history museum in St. Petersburg) and 'Veronica' (nunnery in Galich, Kostromskaya region). One more icon was found not long ago, it was painted for the iconostasis of Samara cathedral. It never left the painter's home region and can be found in the church of the Ascension of Christ in Kinel-Cherkassy. It is believed that some of the fellow townsmen managed to take the icon away from Samara cathedral before it was destroyed.

Malinovsky's search resulted in the museum opened in Zhuravlyov's home village of Utyovka and exhibitions of his paintings in Neftegorsk Museum of Local Lore and Samara Eparchial Museum.

Peasant Madonna

In the latest edition of his book Malinovsky wrote about the letters found in Sverbeev's archives. Zhuravlyov mentioned **Kuzma Danilov**, **Mikhail Hmelyov** and **Vasily Popov** in these letters; they probably were his apprentices. Maybe their relatives will contact Malinovsky if they read his book, as the most famous Zhuravlyov's icon called 'Madonna of Utovka' hasn't been found yet. There are only photographs of it.

"The story of this icon is very unusual. I saw a photo of it in 1960's; at the same period I got to know that people called this icon 'The Madonna of Utyovka'. It was a medium-sized painting of a peasant woman wearing a white kerchief, with a baby in her hands. Simple face typical for the Volga people. Big dark eyes. Barely noticeable smile on her lips. There is nothing religious in it but for some reason it's still treated as an icon. I think that this merge of canonicity and simplicity, whether it was done on purpose or not, displays the painters' heightened sense of life. 'The Madonna of Utyovka' was kept in the house of one of the villagers, a woman whose last name was **Podusova.** In 1964 my friend and I took a black-and-white picture of it. Very few people saw the color image of this icon. In the late 1980's I came to Utyovka to photograph it but people who lived in that house didn't let us go inside. I remember that feeling of desperation and bitterness. I knew that many people wanted to see this icon but I couldn't do anything. By the time I came back to the village that woman had died and the icon had disappeared. I was said that all the icons had been taken by the relatives from Samara but people who lived in that house didn't know their address. There was an exhibition of **Victor Pyilyavky**'s photographs – pictures of churches taken from paraglider – on the Kuibyshev square about ten years ago. I saw these words in the exhibition comment book: 'My daughter Helen has one of Zhuravlyov's icons, the one with Madonna wearing peasant kerchief. We live in Samara near this square.' There were neither telephone number nor address. I have been trying to find this person but for the time being my search has been unsuccessful."

DRILLING MUDS FOR DEEP WELLS

Specialists of the Chair of Oil and Gas Well Drilling at Samara State Technical University develop new types of drilling muds

By Georgy MOZGOVOY

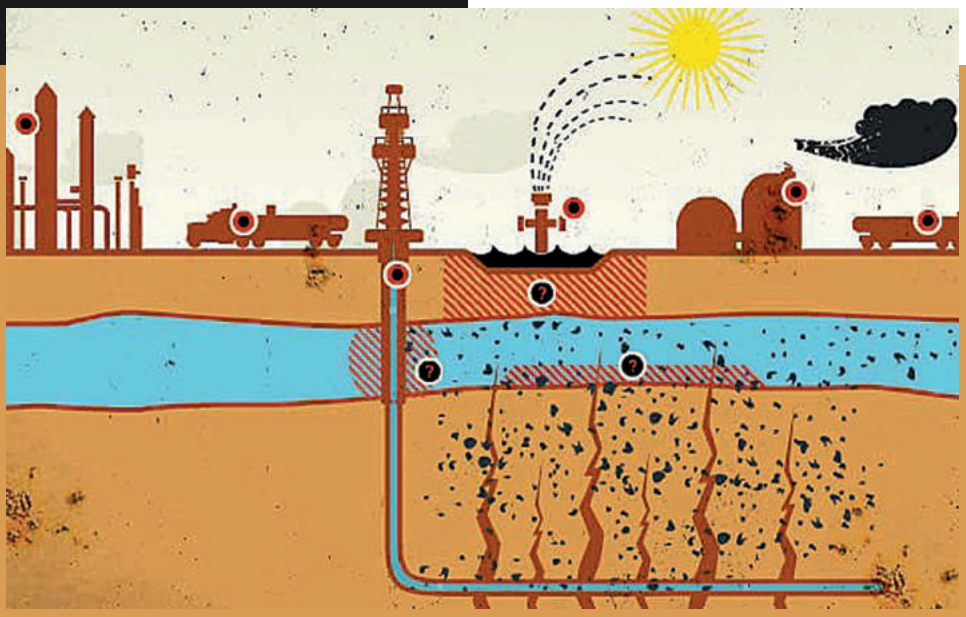
Our vision of mankind's future mostly depends on answers to two questions: "Is there life on Mars?" and "How to get oil from under the ground?". The God of hydrocarbons hid the black gold so deep that description of conditions and methods of getting it may be as interesting as stories about Mars.

Experts say that successful drilling of oil wells is pretty much a matter or composition and properties of drilling muds that must provide safety and fail-safety of drilling, as well as qualitative striking of productive formation.

At the present moment, the main problems that oil workers deal with are caused by instability of rocks during drilling. For example, highly-fractured, dry, fragile clays, as well as clay rocks stratified with fluid-saturated sandstone rocks are considered as extremely unstable. Formations containing aggressive fluids – such as hydrogen sulfide or carbon dioxide – are very hard to strike. Borehole narrowing, slurry plugs, tight pulls and sticking of drilling tool lead to significant economic expenditure. That is why the top priority goal is to provide stress-strain borehole stability in complicated mining and geological conditions.

Drilling muds with carefully adjusted chemical composition help to maintain the specified diameter of a borehole. Specialists of the Chair of Oil and Gas Well Drilling at SSTU have developed new compositions of flushing fluids based on available and inexpensive components.

Drilling mud is a complex mix of suspended, emulsive and aerated fluids used to flush the well during drilling. Drilling mud removes drill cuttings (debris) from underneath the drilling bit and brings them up; it also cools the bit and helps to break rocks in bottom-hole area, creates pressure on the well wall to prevent water, oil and gas showings, exercises physical and chemical effect on the well walls to prevent them from collapsing; drilling mud also preserves permeability of productive formation during striking etc.



▲ Methods and devices developed by the Chair of Drilling allow to do real-time microseismic monitoring of hydraulic fracturing of formation.

Thin clay drilling mud based on urea-formaldehyde resin MF-17

Composition: sodium hydrate, bentonite, modified starch, water-soluble resin MF-17 (or its Russian-made modification), water.

Gel solution

Composition: sodium hydrate, modified starch, sodium silicate, aluminum sulfate, water.

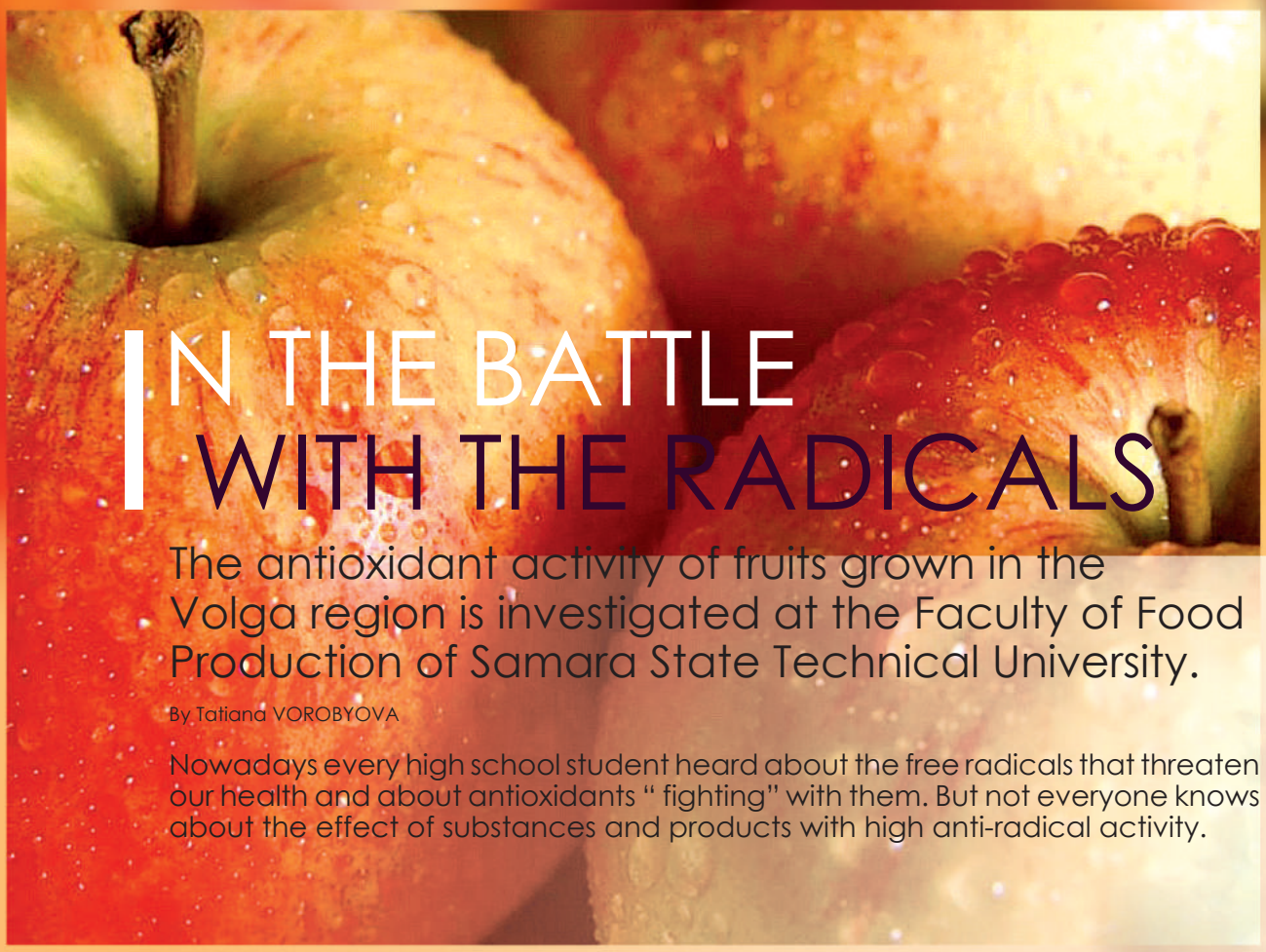
These drilling muds are used at oilfields in the Western Siberia, the Orenburg region, the Samara region and Uzbekistan.

Flushing liquid for drilling unstable rocks and strata with aggressive fluids

Composition: **arboxymethylcellulose**, halite, special Russian-made reagent RDN-U ('all-purpose oil production reagent'), water.

Gel-mix

Composition: dry reagent polymeric system to be mixed with dispersion medium (fresh, mineralized or saturated salt-water solution).



IN THE BATTLE WITH THE RADICALS

The antioxidant activity of fruits grown in the Volga region is investigated at the Faculty of Food Production of Samara State Technical University.

By Tatiana VOROBYOVA

Nowadays every high school student heard about the free radicals that threaten our health and about antioxidants " fighting" with them. But not everyone knows about the effect of substances and products with high anti-radical activity.

Since 2008 the studies of chemical composition and antioxidant activity of fruits grown in the Volga region have been conducted at the Faculty of Food Production of Samara State Technical University. They take material to study from the collections of the Research Institute "Zhiguli gardens", JSC "Koshelevsky Posad", from farmers, amateur gardeners. Our scientists place greater focus on pomefruit trees for a variety of reasons: a large number of apple varieties with different organoleptic characteristics and different chemical compositions, their high productivity, low cost of cultivation and storage.

Numerous medical studies strongly indicate the presence of anti-cancer, anti-diabetic, anti-bacterial, anti-inflammatory properties in apples, as well as their positive role in the prevention of allergies, cardiovascular and muscle diseases.

The results obtained allowed to formulate a number of important conclusions not only from the scientific perspective but also from the consumers' point of view.

For example, the breeders consider "Antonovka" apple varieties to be gold standard for the comparison of physical and chemical properties. However, many other varieties tested such as "Revival", "Red", "Scarlet ", "Raspberry ", "Kuibyshevskoye" have higher content of phenols, flavonoids and antioxidant activity than "Antonovka". And imported apples, on the contrary, have very modest values compared to local varieties.

It is interesting that the majority of the studied chemical parameters of apple fruits has increased by the third month of storage and has decreased by the sixth month. In general, many apple samples have fairly high antioxidant potential during 6 - 8 months.

Berries and stone fruits such as strawberries, raspberries, black and red currant, aronia, cherry, plum and grapes have high antioxidant activity too.

According to Nadezhda Makarova, Doctor of Chemistry, the head of the Department of Food Technology and Organization, the rumors of the extraordinary healing properties of the so-called superfruits such as goji berry, assai, mangosteen, marula that recently appeared on store shelves are greatly exaggerated.

At the Faculty of Food Production some new technologies of obtaining products with antioxidant properties have been developed for apple juice of direct expression, reconstituted juice, apple chips, fruit purees and ice-cream. These products gain antioxidant properties due to special manufacturing techniques or formula used. For example, ice cream enhances its antioxidant status through fruit additives.

Russian fruits and berries having high yields are considered to be an alternative to "super fruits". The objects of our research are seven varieties of honeysuckle, four varieties of actinidia, saskatoon, cornelian cherry, Chinese magnolia vine, wild blackberries and cultivated blackberries of five varieties.

Antioxidants –

are natural or synthetic substances capable of slowing down the oxidation.
They neutralize free radicals (oxidants) activity. Antioxidants prevent the damage of cell membranes and the inner lining of blood vessels.

Oxidants –

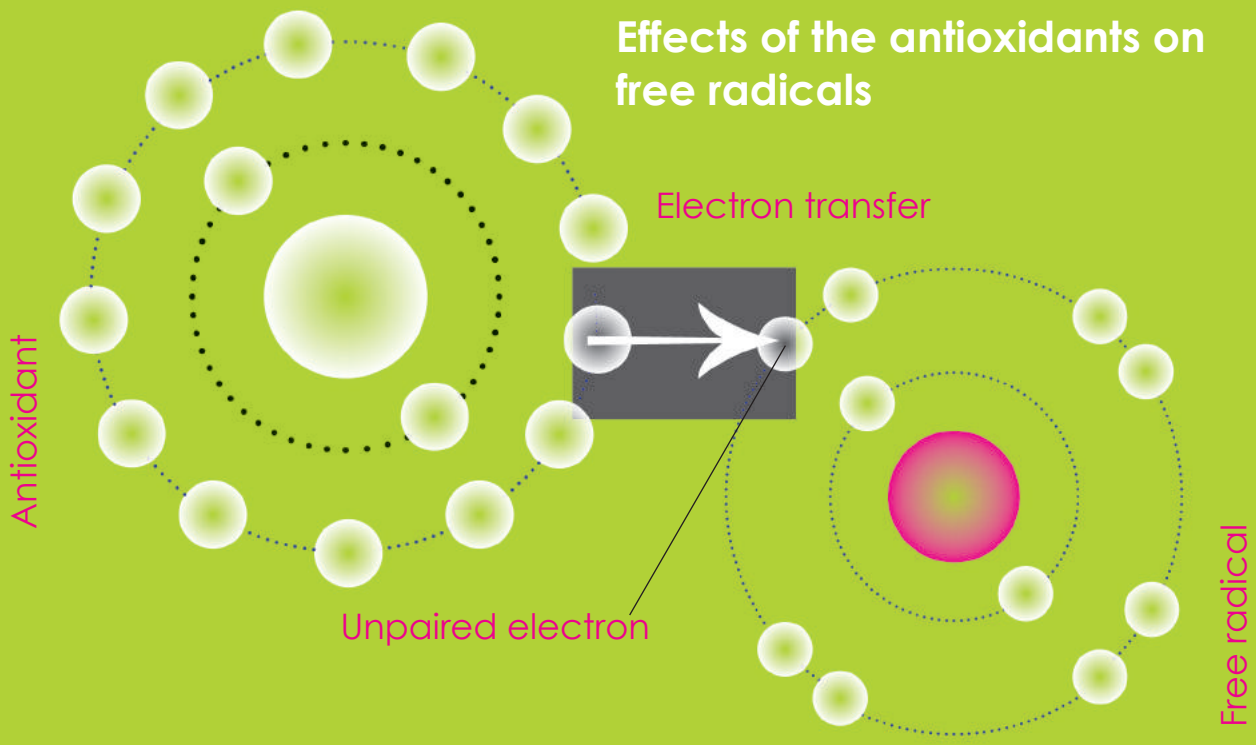
are substances that lack one electron, they "take" it from its neighboring healthy molecules which, in turn, are converted to free radicals.

Honeysuckle (grade "Moscow 23" and "Tornado"), **Actinidia** (grade "Clara Zetkin" and "Mirage"), **Saskatoon**, **cherry**, **chokeberry** and **blackberry** are considered to be leaders in the antioxidant activity among fruits and berries.

Among fresh spices the **dill** and the **basil** show high antioxidant activity. Many dried spices are also useful in helping to improve the antioxidant status.

The bones and the skins contain more antioxidants than the pulp and the juice of the fruit.

Effects of the antioxidants on free radicals



The chain reaction results in the oxidative stress, destruction of cell structure and body tissues. These processes occur endogenously during normal metabolism or exogenously due to radiation, ultraviolet radiation, environmental pollution, and smoking. Free radicals coming into engagement with polyunsaturated fatty acids, proteins and DNA cause arteriosclerosis, Parkinson's disease, Alzheimer's disease and increase the risk of cancer, heart failure, heart attack and stroke.
Antioxidants get to the unstable molecules through the blood vessels and "share" missing electrons resulting in stopping the oxidation processes.

Synthetic antioxidants such as butylhydroxytoluene, butylhydroxyanisole, Tert Butyl Hydroxy Quinone were widely used in the twentieth century.

Some of them are introduced into the food even now to keep the quality due to the prevention of lipid oxidation.

The pharmacy chains and online stores offer a wide range of antioxidant vitamins (Solgar, "Vitrum", "Theravit" and others.). The dosages recommended by manufacturers can be easily replaced by fruits and vegetables.


Actinidia
Cherry
Basil
Chokeberry
Honeysuckle
Shadberry
Dill
Blackberry

Science and Innovation are for the prosperity of Samara and Russia

Explosion with no regrets Maiden's tears is speleologist's joy Russian analogues in heating Chloride, saltpeter and ice crust Keys to tomorrow Light and dark Production of heavy oil will become easier Sintering metal In vino veritas In the smallest details