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Message from the President

MESSAGE FROM NEIL B. GODICK

How things have changed

Prior to the 1917 Russian Revolution when the Czarist government was toppled, Russia was a leading grain exporter. Stupid Stalin policy (the famine) and later the lack of investment destroyed Russia's agricultural production. By 1991, when the Communism government was replaced with an elected government Russia was a poor and hungry grain importer.

Now, some 20 year later, Russia could become the world's second-largest wheat exporter. This would be a first. The Government's export forecast for this year is 26-27 million tons. The Government expects that this year, grain growing areas will be increased by almost 2 million hectares, to 46.2 million hectares.

How things have changed .2

Russians are reading fewer newspapers than before. Polling results show that newspaper readers have become increasingly convinced that Russian mass media outlets are not free enough to be trusted.

Since 2010, the share of Russians reading more than two daily newspapers on a regular basis has decreased from 18% to 12%. Readers that used to skim through one paper a day has fallen to 20%, down from 23%.

The survey reported that Russians are becoming increasingly convinced that the country's mass media are gradually being brought under state control. 39% of respondents in 2012 compared to 46% in 2010 - said that they regarded the Russian press as "absolutely free" or "mostly free". Almost half of the respondents 47% believe Russian mass media outlets are state-controlled. This compares to 45% in 2010.

While some things never change

As many who have tried it can attest - Russia is a tough place to do business. 3 million businessmen have been found guilty of economic crimes and imprisoned over the past decade. This statistic came to light in April when a Presidential advisor reported to then President Dmitry Medvedev. Medvedev's first reaction was that that it was surely an exaggeration. Later his reaction was more reasoned: he said

that the news was shocking. He called this state of affairs a catastrophe. At the end of 2011 there were 7.5 million officially registered businessmen in Russia. Doing the math - the implication is that practically 1/3 of all businesses had troubles with the law.

In other reports we read that most criminal proceedings against businessmen are instituted without an initial complaint and are anything but objective or even substantiated. In Russia a criminal complaint can be filed by other than law enforcement officials.

While some things never change .2

The Chinese newspaper Jenmin Jibao published a highly critical commentary on the Russian economy. We are told, for the Chinese, this is most usual. The Chinese were quite pointed in discussing the results of Dmitry Medvedev's and Vladimir Putin's leadership. The commentary listed six fundamental defects in the Russian economy.

1. Economic dependence on oil and gas exports
2. Administrative barriers that sour the business climate
3. Appalling state of affairs with technologies, sciences, and businesses
4. Absence of competition and the presence of monopolies
5. Inadequate level of development of public capital and self-organizational apathy
6. Demographic parameters including "shortage of labor force"

The Chinese:

- Drew the conclusion that Russia has no alternatives to reforms and installation of a new economic model
- The effects of these defects have been increasing and weighting on the overall state of society

Russian experts found China's attention to Russian economy "interesting". Other Russian experts tried to read between the lines and explain away the commentary by saying they had political undertones and was an attempt by Beijing to try on the role of the future global leader.

We do not intend for the following reports to solve any need our readers may have. We do intend to keep everyone current on technology developments in Russia. If you would like any additional information on any of the developments reported – send us a note.

Material capable of replacing wood and plastic

Scientists from the **National Research Irkutsk State Technical University** developed a novel construction material that can be used as a replacement for wood and plastic. Fly ash from cogeneration plants and polymer waste is used in this new material, *vinizol*.

Vinizol production process includes several stages. The source powder-like components are batched and poured into a bin. The bin

contents are poured into a two-stage high-speed mixer. In this process stage the components are mixed to obtain a dry blend. Then batches of dry blend, filler, and plasticizer are charged into a concrete mixer where the final composition preparation takes place. The product is fed into an extruder bin where it is heated, plasticized, and in the form of melt and under pressure, goes to a direct-flow head. Shaped profiles are produced that are measured and chilled in a bath. Draw-out equipment removed any remaining undesired profile.

The developers claim that, in many ways, *vinizol* is similar to natural wood but has better fire, water and frost resistance, and durability. Its cost is much lower than plastic.

A process line has recently been started that enables the researchers to test the technology and experiment with various material compositions to achieve the best results. This material's structure is porous and has low density (1,182 kg/m³). As a consequence, the thickest, 4.1 mm, has foamed variants. The material contains large spherical and elliptic meshes (50-70 microns). Its bending strength is 36 MPa, and Charpy impact viscosity is 17.24 kJ/m². In its physico-mechanical properties and porous structure, APW is similar to several natural woods, but surpasses them in fire and heat and frost resistance, chemical and biological resistance, and durability. APW is a hydrophobic material; its water absorption does not exceed 0.2%. This is 500 times lower than wood water absorption. The material production technology is very manufacturable. APW products can be made in any shape, length, color, odor, texture or cross section.

The developers say, "Using fly ash and polymer waste as raw materials makes it possible both to save natural resources and manufacture an ecologically safe material at a cost 25-30 per cent lower than the existing analogs. Even though we now have only one process line, it can turn out up to 55,000 square meters of products a year".

#2012-04-234

Russian scientists
modify chitosan for
cancer treatment

Scientists from *Bioenergia* Center, RAS, (lead scientist: A.V. Ilyina) filled nanoparticles based on chitosan polysaccharide chitosan (which has affinity with living organisms) with doxorubicin. Doxorubicin is an antibiotic used in antitumor chemotherapy. This approach mitigated the drug's negative effects while retaining its anticarcinogenic activity.

It is recognized that nanosized drug delivery systems can enhance many therapies. Using them, drugs can overcome various biological barriers (including cellular and nuclear membranes), ensure targeted delivery to affected cells and, in general, be retained in the body for a longer time. However, it is not always possible to work with antitumor drug solutions in their pure form because many drugs have a number of serious side-effects. For example, doxorubicin (DOX)

quickly dissolves in the bloodstream and is also cardio and nephro toxic.

Scientists typically try to solve these problems by binding the drug with an inert carrier. The Russian team from *Bioengineering Center, RAS* used a different carrier, modified chitosan. This is a hyaluronic acid polymer that is extracted from shrimp and crab shells.

The method used to produce doxorubicin filled nanoparticles has several steps. Succinic acid residues are added to chitosan and the modified chitosan is used to produce a nanoparticle suspension. The antibiotic molecules are placed onto these nanoparticles. One mg of nanoparticles can bind up to 170 μg of doxorubicin.

To observe how antibiotic loaded nanoparticles decompose within cells, they were tagged with fluorescein.

Cell culture tests showed that DOX activity within nanoparticles is comparable to activity of DOX dissolved in water. When equal DOX concentrations were added to cells in its soluble form and in nanoparticles, it took the drug the same time to pass into the cell nucleus. Having analyzed its functional activity, the scientists could not detect any difference between DOX and DOX-filled nanoparticles. Thereby verifying that DOX fully retains its properties when included in particles.

The technology has several advantages. Nanoparticles from modified chitosan can effectively bind doxorubicin and deliver the antibiotic to the cell and its nucleus. The nanoparticle encapsulated anticarcinogenic activity is not reduced. The antibiotic's blood circulation time is increased enhancing its cell delivery, increasing its therapeutic effect, and reducing toxicity.

#2012-04-235

A new nanodiamond grinding method

Russian scientists from **Ioffe Physical Technical Institute, RAS and St. Petersburg State Chemical-Pharmaceutical Academy** study optical methods to examine detonation nanodiamonds (DND). According to many publications, DND nanoparticle dimensions are assessed using dynamic light scattering data. The St. Petersburg researchers questioned using this method for particles sized 3–6 nm pointing to significant special features of such small particles' absorption spectra. They also proved, experimentally, that it is possible to make purer nanodiamond suspensions.

During their experiments the researchers, headed by Prof. Eydelman, Head of the Chair of Physics, St. Petersburg State Chemical-Pharmaceutical Academy, first ground nanodiamonds to 4 nm. Their novel method subjected aqueous DND suspensions to multistage heat, acid and ultrasonic treatment. This produced a dark brown opalescent suspension that was purer than suspensions obtained by

the standard method (grinding in a ball mill).

The new suspensions' absorption spectra clearly show higher absorption in the 300 and 600 nm regions. For nanodiamonds ground in a ball mill this could be explained by local heating and surface graphitization, these conditions are eliminated by the new method.

These findings are the first steps toward producing transparent DND with properties that open wider practical application prospects in several fields.

#2012-04-236

The 'ideal' gas sensor

Researchers from Moscow State University and Kurchatov Institute developed a gas sensor based on nanocrystalline indium oxide. Nanocrystalline indium oxide has long been used as a sensitive element to detect nitrogen dioxide in air. Similar materials' electric properties depend on their surface structure. If molecules other than oxygen molecules bind to the indium oxide surface, its conductance immediately changes. The scientists studied how indium oxide nanocrystals' dimensions affect its sensitivity to nitrogen dioxide, and determined the optimum indium oxide particle size for developing a sensor with maximum sensitivity.

Indium oxide sensitivity to nitrogen oxides has long been known: it increases as the specific indium oxide surface grows. It is logical to assume that materials with minimized particle sizes would have the highest sensitivity to nitrogen oxide molecules in air.

The researchers synthesized nanocrystalline indium oxide using a sol-gel method. The material was subjected to high-temperature treatment for 24 hours. They then determined its phase composition, oxide particle dimensions, and determined the specific surface area. During the next stage they measured the samples' electrical conductance relationship to adsorbed nitrogen dioxide amounts.

It was determined that higher sample annealing temperatures produced larger indium oxide nanocrystal size. A substantial change in sample conductivity was detected at a nitrogen oxide concentration of 0.00001% and higher. The indium oxide conductance quickly decreased in nitrogen oxide presence and after a few minutes matched the initial value in the air at the same temperature.

During their experiments the authors found that the highest sensitivity was observed in metal oxide samples with an average nanocrystals size and average specific surface area.

The authors refuted the original theoretical predictions that smaller particles would provide maximum sensor sensitivity. What happens in reality is that as nanocrystals become smaller the sensitivity first increases and then decreases. In their article the authors explain the

phenomenon as follows. *On one hand the sensor signal is determined by the nanocrystals' specific surface, which increases as nanocrystals get smaller. On the other hand, smaller nanocrystals mean lower potential barriers and, consequently, lower sensor signals. Therefore there is an optimum indium oxide particle size with maximum sensitivity to nitrogen oxide.* The scientists calculated that an ideal gas sensor would have particles slightly larger than 8 nm.

#2012-04-237

A global semantic search system

A Moscow IT company developed an information search technology that uses the semantic content of unstructured texts and users' queries. Its recognition and information processing speed is more than double existing analogs.

Currently, search systems use search technologies based on users' keywords. This means that all search options are set manually by users. This approach cannot ensure high search completeness or accuracy. The authors have monitored existing Russian and European semantic search systems used on the Internet and found that it takes them considerable time to gather relevant information. In 50% of the cases the information was not complete or relevant to the request criteria.

The new semantic system prototype is based on stochastic technology and it can identify information in its semantic content. As a result, better search accuracy and information completeness are achieved with the automated evaluation processes for semantic matching texts with users' requests. This reduces the "information noise" and significantly increases answers compliance. This was confirmed by comparative testing with existing "ask-answer" search systems. Test results demonstrated doubled search completeness and accuracy by the prototype compared to the best search system on the Internet. The prototype has been produced in Russian and English.

This technology's speech recognition and semantic interpretation methodology uses patented information processing methods:

- semantic analysis of speech information at every recognition stage;
- complete linguistic analysis to identify the message's semantic content for recognition;
- stochastic methods for signal, unstructured audio and text information processing;
- artificial intelligence methods for data processing.

The system can be integrated with existing global information retrieval systems and used on any electronic device with an operating system, including smartphones.

#2012-04-238

Thermal wind power plant

Scientists from Irkutsk Technical University developed a device that can efficiently heat small houses. The device converts wind energy to heat. This reduces heating system cost and simplifies its design.

It does not always make economic sense to use central heating boiler systems for small houses. Central heating systems currently used for these houses have several disadvantages, e.g., it is impossible to generate heat without using an electric generator to power the boiler. This complicates the heating system and makes it more expensive.

It is much more efficient to use a windmill to convert wind energy directly to heat, and use electric power from external sources as a backup. An existing patent for a device purporting to achieve these results has a disadvantage, the patented technology it cannot pump heated liquid from the heat generator to its storage device. This disadvantage impairs the thermal wind generator performance and leads to unstable heating system operation. The new technology, thermal wind generator, converts wind energy to heat omitting the wind-energy-to-electricity conversion step.

The thermal wind generator can be placed at any elevation in a building and maintains a stable liquid temperature. The device uses forced liquid circulation.

The heat carrier is pumped through the heating system without an energy-consuming pump.

The thermal wind power device simultaneously reduces capital and running costs for heat generation.

#2012-04-239