PHLburg Technologies, Inc.

1275 Drummers Lane
Suite 101
Wayne, PA 19087

Telephone: 610-688-6800
Fax: 610-975-5800
Website: phlburg.com

June 2011

IN THIS ISSUE:

Message from the President
Technology to produce a compact multiuse valve for oil and gas well repair
New-generation high-temperature ceramic composites for power plants and hypersonic aircraft
Scientists develop a new luminescent material
Novosibirsk scientists develop a new fiber optic sensor
Russian scientists tested a device for ventricle of heart replacement
Russian scientists reversibly modify properties of proteins

MESSAGE FROM NEIL B. GODICK

Following the trends in Russia:

Internet users

Internet users in Russia rose 22% in 2010 to 57 million, the Russian Association of Electronic Communications (RAEC) Director Sergei Plugotarenko said Wednesday, ITAR-TASS reported.

Internet users in Russia are expected to increase to 80 million by 2014, Plugotarenko said citing data from the Public Opinion Fund.

Russian Internet users send more than 12 million emails each day, Plugotarenko also said. Meanwhile, users receive 264 million emails daily, 252 million of which are sent by email robots.

Gender discrimination

In a bid to break down the barriers to the corridors of power, new laws against gender discrimination are under consideration after an eight-year hiatus. The regulations made it to the second reading stage back in 2003 only to be put on the back burner since then. But the Duma's (Parliament) Committee on family, women and children's issues has put forward a new version of the law and it would require at least 30 per cent of parliamentary seats to be occupied by women.

To encourage men to play a greater role in family life they would be granted two weeks of paid paternity leave within six months of the birth of their child.

Only 12 per cent of Russian MPs are women, with just three female ministers, and only two per cent of regions headed by women the Nezavisimaya Gazeta reported.

Public health

Most Russians overestimate how healthy they are. Many run high health risks by smoking, abusing alcohol, being obese and failing

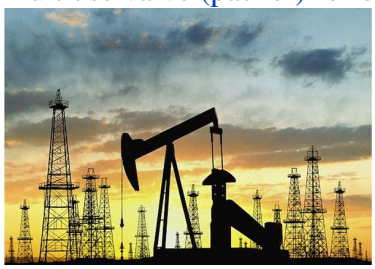
to exercise, according to an Association of International Pharmaceutical Manufacturers, or AIPM, and the International Federation of Pharmaceutical Manufacturers and Associations, report.

About 95 percent of Russians think they are in good or fair health, yet only 44% Russians saw a doctor last year. This could be one of the main reasons why chronic illness diagnosis such as heart disease, cancers, and diabetes is low. Heart disease, strokes, diabetes, cancers and chronic respiratory disease together are responsible for 80 percent of all deaths in Russia. Obviously, there is a significant gap between what people think is their state of health and the negative impact of their actual behavior.

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.

Technology to produce a compact multiuse valve for oil and gas well repair

A **Koltsovo company** has developed a production technology for a multiuse valve (packer) for oil and gas well repair.



The packer is hydraulic, but, unlike its analogs, is fixed in the tube without any special fasteners. Using a patented fastening method, the packer can be easily removed from the well and placed there again without any damage to the pipe or pipe walls.

The device's advantages are:

- it is multiuse and can be extracted from the well without losing its functionality or causing damage to the pipe walls;
- it does not need additional fasteners and can be easily transformed from operating to transporting condition;
- the packer can be used at pressures up to 300 atmospheres (normal well pressure during repair is 150-180 atmospheres);
- owing to its small size no lifting mechanisms for installation or dismantling are needed.

New-generation high-temperature ceramic composites for power

Scientists from FGUP All-Russia Research Institute of Aviation Materials (FGUP *VIAM*) developed a novel technique to obtain a fiber-free structural high-temperature ceramic composite material. The

plants and hypersonic aircraft

material (in the silicon carbide – silicon carbide system) can operate at temperatures up to 1,500 C.

The material has increased working temperatures, heat resistance, and strength over similar materials. The material possesses microdefect self-healing ability that can restore up to 100% of the source physico-mechanical characteristics. It enhances parts' and units' performance in gas turbines and aircraft engines. These characteristics will help develop hypersonic aircraft, enhance engine and gas turbine ecological compatibility, and reduce parts' weight 2–3 times.

The scientists also developed multilevel gradient systems to protect high-temperature carbon-containing composites from oxidation in aggressive media (including plasma-chemical streams) at temperatures up to 2,000 C. These protection systems ensure operational efficiency for high-temperature units and carbon-containing composite components, including those used to develop advanced hypersonic aircraft parts (fuselage nose, front wing edges). The new materials can be used to develop civil equipment in:

- machine-building (auto propulsion devices),
- chemical industry (high-temperature heat exchangers, recuperators),
- metallurgy (high-temperature rigging),
- power industry (new-generation land-based gas-turbine power plants, oil and gas pumping and conveyance systems).

The novel developments are protected by patents covering the composite materials' formulations, their production technology, and products made from the materials.

Russian scientists develop a new luminescent material

Electroluminescence (light emission under the action of an external electric field) is widely used in electronics (e.g. to make displays). Scientists continue to study materials suitable for electroluminescence. A promising group is II and IV group compounds.

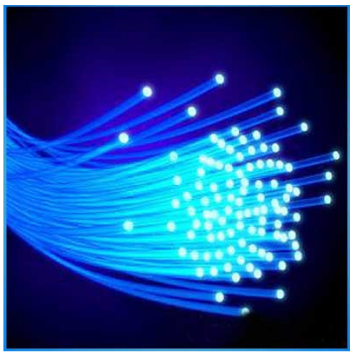
Light is emitted in the contact zone between two different semiconductors. Today luminescent panels are manufactured using thin-film technology. It involves introducing an admixture (a small amount of another semiconductor) into the semiconductor film composition.

Researchers from the Physico-Technical Institute, RAS (Ural Branch), Udmurtian State University and Lomonosov Moscow State University developed the new method.

Their semiconductor uses electroconducting zinc selenide (ZnSe) nanocrystallites embedded during the production process into an amorphous ZnSe matrix. This combination eliminated the standard process used to dope the conducting film. The scientists made amorphous-crystalline zinc selenide film using powder vacuum flash evaporation. An electroluminescent radiator prototype was made by depositing an indium and tin oxide alloy onto a substrate. A working zinc selenide layer was sputtered on the indium-tin oxide. To prevent breakdown, the working layer was also covered on both sides with dielectric layers to limit the current strength. Electrochemical and spectroscopic tests confirmed electroluminescent properties in the structures. The new radiator's maximum luminance intensity is at 335 nm and observed when an external voltage is supplied (270 V, 220 Hz). The number of semiconductor contacts directly depends on the nanocrystalline parts dimensions. Changing the ZnSe nanoparticle size between 5 and 100 nm makes it possible to vary the radiation intensity.

Novosibirsk scientists develop a new fiber optic sensor

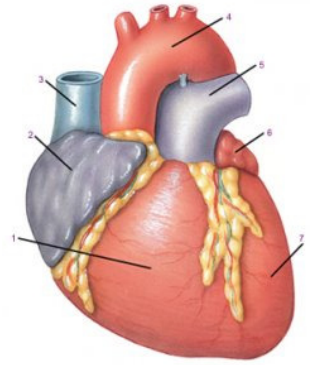
Researchers from the Institute of Automatics and Electrometry, RAS (Siberian Branch) and Institute of Organic Chemistry, RAS (Siberian Branch) designed an optical fiber based chemical sensor that selectively reacts to butylamine. The group headed by Aleksander Plekhanov developed this sensor for butylamine, a very toxic and explosion-prone amine. The sensor's operating principle is based on luminescent dye molecules changing their luminance spectrum by bonding with the toxic agent.



The sensor molecules are built into a silica nanoparticle matrix deposited on the optic fiber face. A laser on the opposite fiber end sends light pulses to the deposited matrix. In response, dye molecules emit their own light which is analyzed by a spectrometer. In ordinary situations a peak in the 660 nm region from the nanofilm can clearly be seen. When the dye binds with butylamine, the 660 nm band disappears and green-yellow luminescence appears at 560 nm. The chemical reaction used is very selective. Compounds similar to butylamine do produce this response. This means that the system is very selective. Its sensitivity can be enhanced by changing the dye-containing film's molecular structure. Depositing a 'mirror' based on artificial opals and introducing silver nanoparticles into it increases the total luminescence intensity tenfold. This opens up prospects for developing selective optical chemical sensors for remote monitoring.

Russian scientists tested a device for ventricle of heart replacement

Russian scientists have successfully completed an experiment on implanting a new rotor pump to replace a heart ventricle. **Dr. Georgi Itkin, Head of the Biotechnical Systems Laboratory, Federal Research Center of Transplantology and Artificial Organs** says: "The pump operates concurrently with the left heart ventricle. Experiments enable evaluating the way the pump operates together with the heart and interacts with blood."

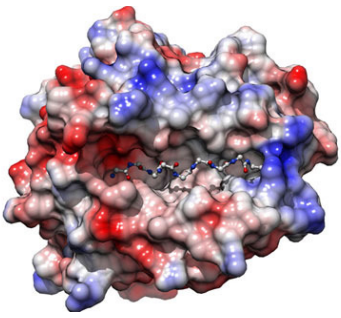


Currently the device is being tested on calves. During experiments over the last two years, four pumps have been developed. For each test the device has been upgraded. The developers claim that, if all the experiments are successfully completed, they can start implanting the rotor pumps in human patients as early as 2012. The device causes

little patient discomfort. After being implanted the patient can leave the hospital and control the apparatus himself/herself. The device is implanted intrathoracically. The pump rotation control unit and two storage cells remain outside the body. They are needed to enable the patient to leave the hospital. The rotor pump replaces only one ventricle.

Russian scientists reversibly modify properties of proteins

Often, natural proteins have properties that are desirable for solving applied biochemical and medical problems. However, these properties (for example, catalytic activity) are typically exhibited in a relatively narrow environmental range. When conditions outside this range are necessary to solve a problem, it is possible to modify the selected protein. Scientists from **A.N. Bakh Institute of Biochemistry, RAS** and **A.V. Topchiev Institute of Petrochemical Synthesis, RAS** are using "smart" polymers that reversibly change protein properties as modifiers. If changes in the environmental pH or temperature parameters are not very significant, "smart" polymers can reversibly change conformation (both its own and the macromolecule's to which they are attached).



To investigate their potential, the researchers modified ovomucoid (hen egg protein) with poly-*N*,*N*-diethylacrylamide – a "smart" polymer. This substance has a beneficial lower critical mixing temperature (LCMT). If the temperature is below LCMT, the polymer is soluble in water, and if it is above LCMT, it changes the conformation and precipitates. The same occurs with macromolecules that this polymer is attached to. An ovomucoid molecule contains three centers that bind digestive enzymes. Two of them recognize trypsin and one – chymotrypsin. By interacting with the enzymes, ovomucoid inhibits their action. After modification the researchers could control the ovomucoid "smart" polymer complex properties by changing the temperature. At heating to a temperature above LCMT (40°C), the modified molecule turned into a globule. In this form it virtually ceased to bind trypsin, but inhibited chymotrypsin much more actively.

The scientists explain that a globule the trypsin recognizing centers'

carriers' properties change. They change the enzyme that they have affinity for and bind with instead of trypsin. But these changes are reversible in character. When a solution with modified proteins and enzymes is cooled below LCMT (30°C), normal activity is restored.

A practical application for this phenomenon was developed, using the polymer gel and modified ovomucoid (which can be produced that selectively binds trypsin or chymotrypsin depending on the temperature). "Smart" polymers can also be used to control biocatalytic reactions. They can be used to directly transport active compounds bound to them. For example, this property can be used in medicine. If we heat up any body part, the entire polymer dissolved in blood will precipitate exactly in that area – together with the medicine attached to it.

Please note: If you no longer wish to receive our newsletter you may **unsubscribe**. To **unsubscribe**, press reply and write UNSUBSCRIBE in the subject line or as the first word in the message body.