



# PHLburg Technologies, Inc.

1275 Drummers Lane  
Suite 101  
Wayne, PA 19087

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

May, 2012

Dear ,

## IN THIS ISSUE:

Message from the President  
The mechanism of biopolymer degradation in the soil  
The first hybrid power transmission line  
Stuttering treatment with computer games  
Gesture-controlled sensor multimedia devices  
Gas-jet deposition technologies for antibacterial metal polymers composed of silver nanoparticles included in a fluoropolymer matrix  
New material from activated coal

## MESSAGE FROM NEIL B. GODICK

### Smoking

A campaign promise made by President Elect Putin was to improve Russia's demographics and to improve public health. One *tool in that effort* is to reduce smoking. Legislation to curtail smoking is now under review in the Russian parliament. If the proposed bill becomes a law, then in a matter of a few years, by 2013-2015, smoking would be banned in public: bars, restaurants, hotels, nightclubs, and transport terminals. Regulations to restrict tobacco product sales are part of the legislation. Cigarette sales would be restricted to special sections in large stores without displays. Also, there would be a two to three-fold increase in the retail price. Today a pack of cigarettes here can be purchased for as little as US 20 cents. The proposed law would ban all tobacco related ads.

Though various polls show that a majority of Russians support restrictions on public smoking, the proposed law may maybe difficult to implement. The tobacco lobby is quite powerful. Further, there is a new Smokers' Rights movement seeking to reshape the law to make it less rigid and "more accommodating" to cigarette-dependent people.

### Who's laughing

According to a recent poll, Russia's students (78%) and bosses (66%) laugh the most, while pensioners (30%) and people who have not completed high school (23%) find little to chuckle about.

Housewives (56%) and highly educated individuals (43%) were next on the list.

Those who tend to be relatively happy are those with a high consumer status (50%) and, inexplicably, supporters of the nationalist and losing candidate Vladimir Zhirinovsky (54%)

37% of Russians get upset by jokes made by their family, friends, and colleagues.

In the office, the most popular pranks involve telling a colleague that the boss wants to see him in his office. The second most popular prank is telling a colleague to perform a task that the boss has supposedly assigned.

### **Who's crying**

Russia's business climate remains high-risk even for entrepreneurs with modest ambition and restrained appetites. There is a 50% chance that any entrepreneur doing business in Russia will sooner or later end up behind bars. So said an expert panel at the International Academic Conference on Economic and Social Development organized by Moscow's Higher School of Economics. Up to 16% of the country's entrepreneurs have been prosecuted in the past decade and no less than 2/3 of companies that ran afoul of the law have been closed, the experts reported.

These experts went on to say that: at the very core of all business issues in Russia is a lack of trust. "There is a perception in government that business people are dishonest. Sadly, this appears to be the prevailing mindset.

That mindset also appears to have been enshrined in the country's legal code. Since 1996, the laws governing economic and financial crimes in Russia have been toughened with the addition of 12 new laws each carrying punishments of 5-10 years in prison. By contrast, in recent years the government has adopted only two laws to ease Russia's business climate.

Russia's culture of *the presumption of guilt* is also reflected in the outcome of court cases involving businesses. The acquittal rate for economic crimes in Russia is just 0.3%.

*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.*

### **The mechanism of biopolymer degradation in the soil**

Synthetic polymers with M<sub>n</sub> as high as 200 are widely produced and used. These polymers are not biodegradable in the natural environment. This limiting characteristic is creating a global ecological problem. In this regard, ever greater attention is being given to developing biopolymers that are decomposed to harmless products by environment microorganisms. These biopolymers are, e.g., polyhydroxyalkanoates (PHA) – polyesters of hydroxyalkanoic acids. Very little is known about the mechanisms of biopolymer degradation by soil using microorganisms. Most studies devoted to biopolymer degradation have been conducted in the laboratory.

**Researchers from several Russian institutes** have discovered how

microbes destroy organic polymers in a natural environment. First they synthesized polyhydroxyalkanoates (PHA) using microorganisms in a biotech process. Then the researchers isolated microorganisms that can decompose PHA. They also studied their ability to decompose polymers depending on their molecular structure and ambient temperature.

The experiment covered two field seasons with a three-year interval in between. Polymer discs were placed under the roots of various trees for about three summer months. During that time the researchers studied the dynamics of changes in the polymer samples' weight. They learned that the PHA degradation process is affected by the polymer's chemical composition. Polyesters with hybrid molecules showed a higher degradation rate; the polymers' amorphous phase decomposed to a greater degree than the crystalline phase. The organic polymers' degradation degree and rate were also found to be dependent on the soil the samples were placed in – under a larch (in a soil that is moister and richer in microorganisms), both PHA types decomposed more actively than under a birch.

Generally, the number of microbes on the polymer disc surface was several orders of magnitude higher than the control soil titer. This indicates that microorganisms (bacteria and fungi) formed colonies on the polymer itself and fed on the polymer substrate, not on substances in the soil.

Further, the researchers determined the qualitative and quantitative microorganism compositions that destroy bioplastics and measured changes in the colonies' species composition on the polymer with time.

These findings provide a deeper insight into the factors that affect PHA biodegradation in soils. These same finding should expand these polymers' application range to manufacturing self-degradable small home appliances.

Longer term, based on these microbial polymer studies, new applications could be found. Biologically active agents, e.g. herbicides or insecticides, could be introduced into the polymer substrates. They will not be released into the environment all at once, but gradually as the polymer structure is being degraded. This gradual releasing will enable maintaining a definite level of the required substance in nature for a long time.

#2012-04-228

The first hybrid power transmission line

**Researchers from several Moscow institutes** have combined efforts to develop and successfully test the world's first hybrid power transmission line. The technology uses two power transmission methods simultaneously – liquid hydrogen flow and electricity flow along a superconducting cable. The researchers created this power

transmission cable line that combines a superconductor and a coolant (liquid hydrogen). This combination both maintains the cable's superconducting state and serves as an energy carrier. Losses for supporting low temperature 'hydroelectric' transmission lines amounts to several tenths of a percent. The ecological compatibility of hydrogen technologies and the superconducting material selected for its low cost – are favorable arguments for the new technology.

MgB<sub>2</sub> (magnesium diboride) strips are used as the superconducting material. The main current-carrying layer includes five strips spirally placed on a copper wide bundle core. The cable is 26 mm in diameter and about 10 m long. Inside the cable structure there is an isolated channel about 12 mm in diameter to carry the cooling liquid parahydrogen. The parahydrogen also circulates in the cavity between the external cable sheath (dia. 28 mm) and the cryostat's internal wall (40 mm).

The new power line was tested on a specialized bench in Voronezh. The prototype included a mockup of the hybrid power line for placing a superconducting cable, the superconducting cable, and lead-in wires.

#2012-04-229

Stuttering treatment with computer games

**Scientists from the Design and Technology Institute of Computer Engineering, RAS (Siberian Branch) and Institute of Physiology, RAMS (Siberian Branch)** developed a diagnosis and treatment system for respiratory biocontrol. The system helps eliminate several conditions, including bronchial asthma symptoms, through controlled breathing. The system also has application in treating anxiety disorders, stuttering, attention deficit syndrome, and hyperactivity.

The device includes a PC with special software and a capnometer – an instrument measuring carbon dioxide concentration in inspired and expired air. The unit works like a joystick, translating the breathing rhythm, which is displayed on the monitor as actions by computer game characters. The games are structured by age: for children aged 5–7, 7–9 and 8–15.

The characters' actions are related to the way the patient breathes. During a one or two week training course the child acquires new attention concentration stereotypes. This helps reduce anxiety and fear levels and enhances stress resistance and social adaptivity.

#2012-04-230

Gesture-controlled sensor multimedia devices

**An entrepreneurial research and production business in Yekaterinburg** has developed a software-hardware system for tracking and recognizing gestures. The unit can be integrated in contact and contactless multimedia devices and used to control them. The technology provides for continuous and smooth streaming with interface devices like interactive table or interactive screen.

Existing contactless control systems for multimedia devices are typically tied to a definite part of the human body such as palms or fingers, or to additional markers with color and geometric characteristics. These systems reduce the gestures' intuitive character for the user. Further, similar systems' recognition potential and data processing rate are not always effective.

Neural networks used by this new technology make it possible to identify the general rules governing a moving object's motion and shape. Additionally, the new system does not need to be tied particular body parts. The end product is a sensor management system for data, including any multimedia data and operating system interfaces, by using gestures. The interactive sensor surfaces developed have the following characteristics:

- Dynamic gesture recognition;
- Static gesture recognition;
- Simultaneous recognition of multiple objects;
- Separates kinetic parameters and determines the object's rotational displacement;
- Operates in real time mode;
- Integration with the Ubuntu and Windows operating systems;
- Horizontal and vertical projection of multimedia content.

Existing market applications include gesture-controlled interfaces for medical and educational institutions, advertising and marketing, performances, entertainment events and amusement parks. User interfaces for mobile devices and cross-platform applications are potential applications, as well.

#2012-04-232

Gas-jet deposition technologies for antibacterial metal polymers composed of silver nanoparticles included in a fluoropolymer matrix

**A small business jointly with a Novosibirsk RAS research institute** developed a technology for vacuum gas-jet metal composite deposition. The technology is based on silver nanoparticles being introduced into a fluoropolymer film matrix. The result is an antibacterial coating with a high and durable antibacterial effect.

The studies involved *Salmonella typhimurium*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *E coli* strains.

The metal-polymer coatings can be deposited on surfaces from two sources: fluoropolymer and silver nanoparticles in argon flow. By regulating the exposure time and gasodynamic parameters in the sources, coatings with predetermined thickness can be made.

As part of the development, the researchers determined the optimum metal-polymer coating thickness for antibacterial properties and the antibacterial effect lifetime.

The new technology's key advantages are:

- higher antibacterial effect than pure silver;
- does not cause allergic reactions;
- longer antibacterial effect than other available technologies;
- a wide range of potential applications: medicine, light industry, food processing and other sectors;
- the technology is controllable; it is possible to produce coatings with different thickness and nanosilver content in the polymer matrix.

Metal-polymer samples with a silver concentration of about 72% on stainless steel, fluoroplastic F-4, aluminum, copper M3, gauze bandage and silicon were produced and studied.

It was determined that metal-polymer coatings deposited on the bandage, copper or fluoroplastic tape surface have a highly expressed bactericidal activity. While a metal-polymer coating deposited onto stainless steel only has a bacteriostatic effect.

The room temperature storage lifetime for the coating's antibacterial properties is greater than 8 months.

#2012-04-233

New material from  
activated coal

**Scientists from Sklifosovsky R&D Institute and Mendeleev Russian Chemical Technological University** have developed a new medical material. Activated carbon with a surface modified by polypyrrole, has wide application in hemosorption. The new material's efficacy and safety have been experimentally verified.

Hemosorption is a treatment method for blood purification. It is often necessary after sharp poisoning with medical preparations or chemical toxins. It would appear that ordinary activated carbon is an ideal solution. Its extensive surface makes it a sufficiently effective adsorbent of toxic organic substances. Activated carbon's positive charge on some atoms binds harmful materials' negatively charged ions. However, about 30 years ago it was shown that activated carbon fatally affects erythrocytes. , Frequently activated carbon destroys them upon contact.

For many years scientists have been searching for a way to modify activated carbon to enhance its biocompatibility. The Russian research team was the first to suggest a new approach to this problem: pyrrole electropolymerization on the surface of commercially available AG-3 carbon to form a conductive polymer.

The open-circuit voltage retained in the material after the circuit is interrupted is considered a key indicator for biocompatibility. In

biocompatible materials this index is between 50 and 150 mV, while for activated carbon it runs into hundreds mV. Experiments performed in physiological solution, after modification with polypyrrole, show this value falls and reaches the maximum admissible limit.

The researchers then examined the hemoglobin and erythrocyte levels from a solution activated carbon with erythrocytes. Contact with pure AG-3 kills red blood cells, and free hemoglobin molecules appear in the solution. In a similar solution with modified carbon, no hemoglobin molecules were observed. And finally, they studied the new material's adsorption activity, where chlorprothixene is used as the toxic substance. The findings were unexpected – the activity of polypyrrole-modified carbon grew by 25 percent. This confirms that the carbon material with a modified surface obtained by the researchers opens new possibilities for detoxification medicine.

#2012-04-231