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MESSAGE FROM NEIL B. GODICK

We have written in the past about corruption in Russia. It appears that Russia Federal Government is taking action to address the problem.

A draft law "On the Use of Polygraph Examinations" has been completed. A provision of the law requires all Russian citizens who have access to *state secrets* to undergo a polygraph test. There is hope, depending on the definition of the term *state secret,* that the law becomes an effective tool in the fight against corruption, bureaucratic lawlessness, and treason.

For those affected, there are fears that the legislation's adoption will be a rather difficult and painful process - it will affect many officials on a very personal level.

The draft legislation requires all Russian citizens who have access to *state secrets* to undergo a lie detector test. Experts say that *state secrets* information could be found in every state agency. With such a definition all high-ranking and middle-ranking national officials will be subject to examination and their work becoming transparent.

Under the draft legislation, examinations could be periodic and unscheduled. Perhaps, questions regarding income declarations will be the most frequently asked by polygraph examiners. Under the draft law, state employees have the right to refuse to take a polygraph test. But, the state has the right to terminate the employee.

We do not intend for these 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.

Power plant for wave energy conversion

Power plant for wave energy conversion

Lomonosov Moscow State University (Moscow) Science Park has developed a power plant for converting wave energy to electricity.

The technology's special design feature is using a Savonius rotor for wave energy conversion. In this case there is no guiding device and waves come directly to the rotor. The technology enables more efficient wave energy use for turbine rotation. Both vertical and horizontal wave energy components are used by this design. The

design compensates for the Savonius rotor turbine's low efficiency. The plant uses low waves close to the shore at a depth of about 10 m. Savonius rotor turbines cost much less than other turbines.

The plant's key advantages are:
low material consumption (all units are protected from large waves);
low cost (the turbine is low cost);
energy transfer simplicity (due to proximity to the shore and placing the plant on a carrier ship);
mobility (it is possible to place the plant close to the end user);
low energy cost (compared to electricity generated by hydrocarbon raw materials).
#2010-01-061

Relict bacteria as an old-age remedy

Relict bacteria as an old-age remedy

Tyumen Research Center of RAS Siberian Branch (Tyumen) has studied certain types of ancient bacteria. These bacteria have incredible vitality and can breathe new life into the body. These microorganisms were excavated from the underground. Soil lumps with rare bacteria were brought from an Arctic expedition. Some samples were collected from drilled wells. These samples belong to the Pleistocene epoch. Their age is 30-35 thousand years.

Studies show that relict (ancient) bacilli have many special features. The chief one is their incredible vitality. Experiments on mice showed that these bacteria can impart their vitality to mammals. Under relict microorganisms' influence laboratory animals' muscular strength increases 5-10 times. Test animals show unheard-of physical capabilities and break all longevity records. Elderly species show wonderful spatial orientation. Their reproductive function remains intact. These findings on mammals will soon be published.
#2010-01-062

A magic biochip

Breast cancer is the most frequent oncological disease among females. Every ninth woman in the world has the disease at some point in her life. About 10 % of these cases are due to hereditary

mutations. Two genes have been characterized whose mutations result in family breast and ovarian cancer types. The cancer development risk in young mutation carriers is 10 times the normal risk. In addition to the hereditary factor a general growth in morbidity and mortality from breast and ovarian cancer was also observed. Developing methods for early malignant diagnosis is an extremely urgent problem.

An original approach to this problem was developed at Engelhardt Institute of Molecular Biology of RAS (Moscow) by using hydrogel biochips. The approach is based on simultaneously determining several molecular breast and ovarian cancer markers. The biological microchip uses an array of gel cells. Inside the cells are specific antibodies to the cancer markers in question (one antibody type per marker in each cell). The technology enables simultaneous protein diagnosis and multi-parametric analysis.

#2010-01-063

Physical and chemical processes in rocket engines at the nanolevel

Physical and chemical processes in rocket engines at the nanolevel

Modern liquid-fuel rocket engines (based on the principles suggested by Tsiolkovsky) require further upgrading. Their operating life is limited by aggressive rocket fuel combustion products on the combustion chamber material. This may destroy the engine's heat-resistant coating and combustion chamber walls. What is the reason for failed space rockets' launchings? What are the physical and chemical processes inside the combustion chamber? What happens to the material at the atomic and nanolevels? The Keldysh Research Center (Moscow) is looking for answers to these questions.

Keldysh Center has studied interaction processes between combustion products (kerosene and oxygen) and liquid-fuel rocket engine's heat-resistant chromium-nickel galvanic coating and combustion chamber copper wall. The studies covered the 600 to 1800 °C under pressures from 80 to 160 atm.

Several physical and chemical processes take place in the rocket engine's combustion chamber. First the combustion products cling to the combustion chamber walls. A physical adsorption process takes place. Then chemical processes (chemisorption, sublimation and evaporation) begin on the wall surfaces. The combustion products penetrate the heat-resistant coating and combustion chamber walls and chemically interact.

Reactions with hydrogen in the combustion chamber make the metals brittle. This is because hydrogen penetrates the coating and forms hydrides. Hydrogen chemically interacts with various elements and phases in metals and alloys. It penetrates microcavities, pores and microcracks on the combustion chamber surface. Hydrogen dissolves in the metal crystal lattice in the atomic state. Chemisorption occurs, and chromium, nickel and copper form perfect solutions with hydrogen. As the temperature grows the adsorbed hydrogen quantity increases.

Another reason for combustion chamber wall destruction is interaction with carbon. Carbon is formed from carbon oxide on the metal coating. The sooty carbon can self-organize into fibers. Carbon concentrated on the chromium coating can sweat and a crack forms. Carbon nanostructures may break off under the gas flow action and carry off metal coating particles. The heat-resistant coating may also be destroyed by oxygen that oxidizes copper and chromium and causes erosion. At high temperatures, gas flow elements (carbon and oxygen) interact with the heat-resistant coating and the combustion chamber walls. This also makes the chromium layer brittle due to oxide, carbide and carbon nanofiber formation.

The studies conducted will help clarify the reasons for failed space launchings. From the studies new nanomaterials with the required properties will be developed. The nanomaterials will find application in liquid-fuel rocket engines used for future space missions.
#2010-01-064

New seismic prospecting technology

New seismic prospecting technology

Seismo-Shelf (Saint-Petersburg) has developed a technology for total

undersea seismic prospecting (commercial label: dense seismic on sea floor). The technology is based on a four-component (a hydrophone and three geophones) standalone self-float seafloor stations. The device enables measuring both longitudinal and lateral waves. This increases the seismic data volume obtained. The development can be used on complex land-sea deposits. It can significantly simplify the Russian shelf development problem.

Gasprom expressed interest in this technology. Seafloor stations can be used on complex Yamal Peninsula deposits. The technology has passed expert examination at Gasprom's Central Institute.
#2010-01-065

Surprising transformations of phosphates

Surprising transformations of phosphates

Phosphates are a key research area at Kurnakov Institute of General and Inorganic Chemistry, RAS (Moscow). Phosphates are valuable mineral raw materials. They are also important for living organisms. They participate in bone tissue formation and supplying energy to the body.

The researchers' goal was to obtain a stable structure with high-mobility ions. A relatively high protonic conductance can only be achieved for finely dispersed acid phosphate. Its particles are sized from a few to tens of nanometers. Large quantities of high-mobility water molecules are sorbed on their surface. Protonated phosphate-anion dissociation ensures proton supply to this water monolayer. However, a relatively small increase in the temperature destroys this water coating. Thereafter conductance quickly falls.

The researchers' attention was attracted by phosphate ($Zr(HPO_4)_2 \cdot H_2O$) with NASICON (Na Superionic Conductor) structure. This compound has a relatively simple structure. Each atom is connected with one zirconium and one phosphorus. This unique structure has many volume voids that form a 3D channel network where ions can move. Moreover, small changes may form new structural types. This allows many phase transfers. Many substances show a sharp increase in ionic defect concentration and in ionic conductance. X-ray phase analysis data show that around 50 °C a phase transfer occurs in NASICON structured phosphate. From a low-temperature triclinic crystal, a high-temperature hexagonal crystal is formed. Using NMR it was shown that this phase transfer occurs in an unusual way. Two phases coexist within a certain temperature interval in this phosphate. The phase transfer has some hysteresis. Since the phase transfer involves transferring part of the structure into the disordered state, its thermal effect is very low. Even minor exposures may cause significant shifts. This allows substituting a small zirconium amount for tri- or five-valent cations results in noticeable transfer temperature reduction. In the process, the two-phase temperature coexistence region considerably extends.
#2010-01-066