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MESSAGE FROM NEIL B. GODICK

For centuries, the Russian Orthodox Church and the Russian State have had a close relationship. It's the Byzantine tradition! Like much in the Russian society, relationships with the State change. The Church's positions over time have gone from favored to disadvantaged back to favored. Regardless of whether the Church has been in or out of favor with the Russian government, it has always been influential. Today the Church has a new and different power in Russia.

For the past 10 years the Church and State have been aligned. The Russian government accepts this *loyal opposition* in trade for the Church being the *guarantor of social peace and unity*. A recent survey reports that "a majority of the population trusts the Church and regards it as an institution capable of communicating values and strengthening unity within the society."

In the early 1990's, the Church questioned the wisdom of democracy, capitalism, and open society. These changes, the Church said, brought increased poverty, social insecurity, and moral liberalism to society. These societal changes were difficult for the Church to *gain control of* and understand. The Church is lead by the Patriarch. The Patriarch, Alexey II, died in December. His successor will be chosen by a body of religious leaders.

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.

Mechanics – Oil Free Air Compressor

Moscow inventors have patented a new oil-free air compressor (RU 2238436). The new design enables:

- eliminating air leaks, step-up gear, axial thrust, wear parts (connecting rods, pistons, crankshafts, valves),
- reduced noise and vibration,
- simplified cooling,
- reduced power consumption.

The compressor has reduced/no down time or idling time. Its failure-free operation warranty period is 30,000 hours.

The compressor system has a wide range of applications:

- for transportation, unloading, supply, packing cement, grain, flour, fertilizers;
- filtration, vacuum casting, vacuum gas sampling, aeration of water, reserve oil gas utilization, supply of gases for chemistry, metallurgy, textile machines, etc.
- new air conditioners, vacuum pumps, oxygen, refrigerating and ventilation systems for buildings, vehicles, refrigerators, operation rooms, etc.

Physics – Magnetic Systems

Academician A.A. Bochvar All-Russia Research Institute of Inorganic Materials (Moscow, www.bochvar.ru, www.vniinm.ru)

has developed and patented nano-crystal high-gradient magnetic systems. The system includes constant nano-crystal magnets based on Kittel's open domain structure. The system produces strong high-gradient magnetic fields with a value of power production that is orders of magnitude higher than that of existing magnetic systems. The system provides the sensitivity necessary for work with low-magnetic materials, in particular, with powders of para and dia magnetic materials. Using this system, installations can be developed for:

- Separating and fine purification of powders of para and dia magnetic substances and materials;
- Water treatment and filtration to remove finely dispersed impurities;
- Gas cleaning and gas separation.

Biotechnology - Alternative Fuels

ASPECT Association (Moscow, www.aspect.ru) develops systems that produce electricity with 70% efficiency from non-food vegetative waste. The new technology is in its ability to obtain practically pure methane. This methane is a complete analog of natural gas. Non-food vegetative waste is burnt to produce the methane. The methane produces the electricity. The source raw materials are agricultural waste, non-market wood and non-food organic production wastes from spirit and beer production.

Four basic units comprise the power plant. First, the source raw materials will undergo mechanochemical processing. The produced biomass will then be broken down using enzymes. The Disintegration product will be biogas, which is a mixture of methane and carbon dioxide with an insignificant percentage of impurities. Biogas will enter the membrane separators that help remove carbon dioxide from the mixture. Then pure methane is used as fuel for the microturbines producing electricity. Two types of membrane separators enabling the separation of methane from carbon dioxide have been developed and patented by **A.V. Topchiev Institute of Petrochemical Synthesis, RAS (Moscow, www.ips.ac.ru)**. The design capacity of the future installation is 100 W of electricity and 150 W of heat. But these values can vary within a fairly wide range.

Chemistry – Polymer
Synthesis

The technology is completely no-waste. The solid reaction products remaining after processing the raw materials into biogas are used as fertilizers. The quality of the carbon dioxide separated from biogas in the membrane separator is sufficient for producing food-grade carbonic acid. The carbonic acid is used, for example, as a growth-promoting factor in plants grown in hothouses.

A.N. Nesmeyanov Institute of Elemento-organic Compounds (INEOS, RAS, Moscow, www.ineos.ac.ru) has developed a technology for using ionic liquids in synthesizing polymers. Ionic liquids are salts that are liquid at 0 - 150°C and consist of an organic cation and organic or inorganic anion.

Polymers are obtained in various ionic liquids media by polyfunctional condensation. In the absence of catalysts, high-molecular polyimides were obtained: films, plastics, varnishes, fibers, pressing compositions, etc. In the absence of catalysts ionic liquids catalyze the polyimide formation process and result in synthesizing polymers with high molecular weight. By applying traditional organic solvents, ionic liquids in catalytic quantities catalyze polyfunctional condensation much more effectively than the typically used benzoic acid.

By low-temperature polyfunctional condensation it is possible to produce polyamides: films, membranes, plastics, varnishes, fibers, compositions, etc. Ionic liquids make it possible to obtain these polymers without adding pyridine and the lithium salts. Pyridine and the lithium salts are usually necessary when using the traditional organic solvents, poly(1,3,4-oxadiazols): films, thermo-and chemically resistant plastics, fibers, gas-separation membranes.

In an ionic liquids medium, poly-ring formation proceeds at 210°C for 2-5 hours whereas it is typically conducted at 350°C for 20-24 hours (the two-stage method) or at 140°C in oleum or polyphosphoric acid (the single-stage method).

Ionic liquids also enable synthesizing functionalized poly(1,3,4-oxadiazols) containing free sulfo - or phosphoric acid groups.

Chemistry –
Antimicrobial Threads

Central Research Institute of Cotton Industry (TsNIKhBI, Moscow, [//fgup-tsnikhbi.narod.ru](http://fgup-tsnikhbi.narod.ru)) has developed highly comfortable antimicrobial sports knitwear. It is made using special polyester bioactive micro-filament threads (inner side). These threads provide protection against microorganisms. These threads provide for effective moisture removal to the outer hydrophilic layers, creating a dry medium and ideal body comfort. Applications:

- Sports underwear,
- Sportswear;

- Special purpose underwear: for the military, law-enforcement and rescue service officers.

Technical characteristics of these materials: thickness 0.8-1.2mm, surface density 165-210g/m², hygroscopicity 11.5%, moisture-yielding ability 70 %, air permeability 500dm³/m²s.

The technologies to produce these knitted materials are in production. A Russian factory is manufacturing comfortable antimicrobial knitwear.

Health Care – Express Diagnosis

Institute of Solid State Physics, RAS (IFFT RAS, Chernogolovka, www.issp.ac.ru) has developed a system for express diagnosis of viruses, carcinogenic and other pathogenic bio-objects within living organisms. The diagnosis is based on nano-scintillators. The system uses nano-scintillators' unique ability to change the crystalline structure and optical and X-ray spectrums at adsorption of viruses and other pathogenic bio-objects by the nano-scintillator surfaces. The following developments by IFFT, RAS are used in the diagnostic system:

- Scintillation nano-particles with a wide range of compositions and morphologies;
- Vicinal surfaces of monocrystals with nano-steps which select *nano-scintillators – pathogenic bio-object of a definite type* pairs that are selectively bonded,
- 3-D X-ray detectors based on light guides from profiled sapphire and nano-scintillators that instantly register changes in the X-ray diffraction angular spectrums of nano-particles,
- Computer programs for determining the location and quantity of pathogenic objects within the body by images of X-ray diffraction of nano-scintillators specially selected for bonding with pathogenic objects.

The express diagnosis system for pathogenic objects within living organisms is unique. Other diagnostic systems analyze samples taken from the patient. This extractive method takes a certain amount of time (usually a day or more) and laboratory analysis. An important advantage of the express diagnostic system is its ability to locate pathogenic objects in an organism by X-ray diffraction. This method includes the potential to destroy the pathogens directly. Accordingly, in the course of the diagnostic examination using the same X-ray set a corrective procedure can be performed. Capturing the pathological objects is assured by the nano-scintillators whose X-ray absorption spectrum resonance is matched with that X-ray radiation source. This results in a highly efficient selective X-ray energy absorption and destruction of pathogenic objects by it without damaging healthy components of the body. A number of leading medical centers in Russia are about to participate in clinical trials.

Chemistry –
Electrochemical
generator

Ural industrialists have developed an electrochemical generator to replace the internal combustion engine. The generator was developed using unique nanotechnologies developed at the **Uralsky Electrochemical Integrated Works (Novouralsk, www.ueip.ru)**. The generator's operating principles are based on fuel cell developments applied in the space industry. At its facility, a pilot generator has already been produced. It is installed in an automobile and is already demonstrating superior road performance. Production costs are still too high and this is being addressed. The development is being carried out in cooperation with Autovaz (Tolyatti, www.lada-auto.ru), which is very interested in the new engine.