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This document has been produced with the financial assistance of the governments of Canada, the European Union, and the United States of America, as Parties to the Agreement Establishing the Science and Technology Center in Ukraine(STCU)

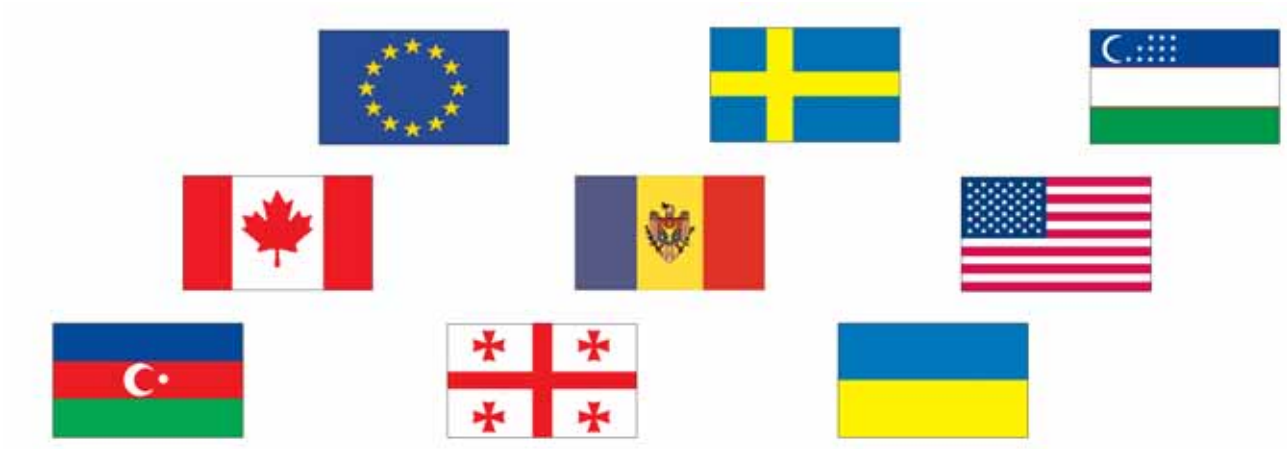
WELCOME FROM THE CHAIRMAN OF THE BOARD

ZORAN STANČIČ
Chairman of the STCU Governing Board

During the past year, STCU continued to accomplish its mission successfully by creating opportunities for permanent redirection of the Ukrainian and other CIS scientists having skills originally developed for the Soviet Union military. It did so through a variety of tools that it has developed over the years, adapting itself continuously to a changing environment. Today, STCU has proved itself as one of the main multilateral instruments to complement the overall restructuring of the R&D weapons complex in the countries of the former Soviet Union.

In 2006, regular projects continued to receive an important part of the Parties' overall funding, although the volume of the funds allocated to these projects is decreasing. The regular projects cover areas recognized as being of great importance for funding activities in the Recipient countries. They represent a valuable contribution to the efforts of the international scientific community to achieve world class research and technology in the CIS nations. At the same time, activities aimed at a permanent self-sustainability of the Ukrainian and other CIS scientists and laboratories are expanding. The nature of the Parties' funding is, therefore, progressively shifting towards these activities. Among them, the Targeted R&D Initiative Program is an important instrument for self-sustainability and for further integration of the CIS scientists into the international scientific community. Following the success of the Ukrainian initiative, the Georgian National Science Foundation and the STCU signed a Statement of Cooperation that initiates a Targeted R&D Initiative program between the two organizations. Other Government agencies of the Recipient countries have communicated their interest in participating in this program and therefore becoming more active partners in the STCU. Moreover, the Partners Program, which creates conditions for the market's commercial exploitation of technologies, generating income and hence sustainable jobs, has been an important portion of the overall STCU project funding. STCU will pursue t trend actively in the future.

Along with the implementation of all these activities, the STCU Parties have been engaged, in collaboration with the STCU Secretariat, in discussions on the way forward. These ongoing discussions allow all entities involved to take stock of STCU's achievements since its inception, but also to anticipate and plan for the formidable challenges it is still facing. Important trends have emerged in the last few years that could have an impact on STCU's programs, procedures, staffing capabilities and overall mission in the



near-, medium-, and long-term. These trends indicate that the STCU will be operating in a different environment with respect to the updated fiscal and programming context. STCU is a unique and valuable organization committed to non-proliferation through cooperative science with efficiency, honesty, and transparency. Cooperation in Science for peace, now more than ever, is what Humanity needs. But, no matter how noble its objectives may be, an organization cannot succeed without dedicated individuals, committed to the mission of the organization and devoting themselves to fulfill these objectives. On behalf of all members of the Governing Board, I wish, therefore, to extend my sincere gratitude and my congratulations to the STCU Executive Director and the other members of the STCU Management Committee, to the Parties' delegations, and to our STCU staff in Kyev and the Branch Offices for the excellent work they are carrying out in order to achieve the STCU's objectives.

Last, but not least, I wish to express my sincere appreciation to the scientists in Ukraine and the other CIS countries who, sometimes under adverse circumstances, are keeping up their tradition of scientific excellence.

To Learn More About Joining the STCU Partner Program, Visit www.stcu.int/offer

WELCOME FROM THE STCU EXECUTIVE DIRECTOR

ANDREW A. HOOD
STCU Executive Director

STCU activities in 2006 saw an unusual set of contrasts, which may be indicative of the period of transition approaching STCU: the largest ever total of new project funding, expanding supplemental programs, and joint Party partnerships was juxtaposed against indications of major program adjustments from some of the STCU Governing Parties. For the STCU Secretariat, these contrasts create both opportunities and challenges, impacting both the current STCU programmatic and administrative activities, and near-term planning and budget considerations. However, a common thread among these contrasts of 2006 is the idea of STCU as a catalyst for cooperation among different sponsors, customers, and stakeholders. The programmatic and administrative flexibility of the STCU Secretariat helps to combine the mandate of nonproliferation of WMD expertise with the implementation needs of the Governing Parties, other security assistance governmental programs, commercial technology customers, and national and regional S&T agencies. STCU, as an integrator and implementer of cooperative activity, was an underlying theme for 2006 and will continue to underline the STCU long-term future.

One of highlights of 2006 was the steep growth in approved STCU project funding, a sudden reversal of the declining funding of the previous 4 years. In fact, the year 2006 saw the highest single year total of newly approved project funding in the history of STCU (almost US$20 million, compared to US$13 million in 2005). A closer examination reveals that STCU saw significant increases of new Partner Project funding in 2006: compared to the average level of funding from the previous 5-year period (2001- 2005), 2006 saw a 94% increase in Governmental Partner Project funding and a 74% increase in Non-Governmental Partner Project funding. With the steady level of regular project funding from the STCU Governing Parties, the Partners Program grew to over 50% of the new STCU project funding approved in 2006. Expanding the Partners Program is one of the STCU near-term objectives, demonstrating recognition by external customers of STCU credibility and utility, as well as STCU's ability to combine its nonproliferation objectives with external customer needs. In the STCU Governing Board discussions about the STCU future, one important consideration will be the STCU ability to balance a variety of programs and a broad set of pubic and private sector sponsors. STCU could be a useful implementation tool for governmental and non-governmental customers alike, particularly programs in security-related areas closely associated with the STCU nonproliferation

mandate (e.g., technology for defense against terrorism; for security and control of sensitive materials; for border security monitoring or forensic analysis of intercepted items, etc.). A successful Partners Program is important to STCU's credible reputation among these potential customers.

Another 2006 highlight was the success of the STCU Targeted R&D Initiatives Program, which combines the interests and financing of the traditional STCU Financing Parties and the emerging Recipient Parties (Ukraine, Azerbaijan, Georgia, Moldova, and Uzbekistan). In 2006, the second Targeted Initiative cycle between the STCU and the National Academy of Sciences of Ukraine (NASU) was completed, with 10 out of 23 submitted proposals selected jointly by reviewing experts of Canada, the EU, the United States, and Ukraine. The 10 selected projects, totaling approximately US$1 million, targeted the research of former weapon scientists onto Ukrainian national priority areas of nanotechnology, energy conservation & industrial safety, and information technology. As in 2005, the matching Ukrainian/NASU funding (US$500,000) continued the commitment to equal partnership between the STCU members.

Based on this success, new STCU Targeted Initiatives are being started. A Targeted Initiative between STCU and Georgia (represented by the Georgian National Science Foundation) was initiated at the end of 2006, and Targeted Initiatives with Azerbaijan and Moldova are in the final planning stages. Other Ukrainian government ministries have inquired about the program, raising the possibility of diversifying the Targeted Initiatives Program and deepening the cooperative involvement of the STCU Recipient Parties.

STCU supplemental programs to help former weapon scientists create successful, self-sustaining civilian employment received a significant boost in 2006 with the arrival of a Deputy Executive Director (U.S.) with career experience in technology transfer. The STCU's newest sustainability development effort, called the Chief Technology Commercialization Officer (CTCO) Program, was kicked off at the end of 2006. Ten Ukrainian institutes agreed to support a "technology transfer office" within their institute, and each nominated a staff member to be CTCO candidates. These "chief technology commercialization officers" will participate in STCU sponsored training, travel to commercial technology events, and homework assignments using the candidate's own institute. The CTCO program seeks to increase the institutes' level of successful self-sustainability by building its own, in-house technology transfer expertise. This pilot program has attracted the attention of the National Academy of Sciences in Ukraine, which is interested in leveraging STCU's work with its own efforts in technology transfer and innovation improvement.

In contrast to the 2006 achievements of these existing STCU activities are the evolving programmatic approaches among the STCU Governing Parties. The United States has stated it wants to focus less on sponsoring individual research projects and more on a broader approach addressing the end state self sustainability of institutes with former weapon scientists. Although still favoring collaborative projects, Canada and the EU also have shown more selectivity in their project funding decisions, to better match these projects to Canadian and EU priorities. Thus, moving STCU's current, project volume-based operational scheme toward managing "fewer but larger" activities will challenge the Secretariat to adjust (as necessary) its planning, administrative processes, and staff profile.

Yet in the face of historic levels of new project funding, STCU's primary administrative activity will continue to be managing a large volume of individual cooperative research projects driven by the expanding Partners and Recipient Party activity. The STCU Secretariat will face a complex period of operational planning, where the current project-based scheme is maintained while existing supplemental programs are expanding, and new program adjustments are introduced by the STCU Parties. The Secretariat will need work with the Governing Parties on a future strategy that builds on the STCU ability to balance all these issues, so that STCU continues to be a successful catalyst of multilateral security & stability cooperation in the future.

MAJOR EVENTS AND ACCOMPLISHMENTS

NSAU Representatives Visit STCU

On 16 February Yuriy Alexeev, the Director General of National Space Agency of Ukraine (NSAU), met Executive Director Andrew Hood and other STCU staff. Mr. Alexeev was accompanied by Eduard Kuznetsov, Deputy General Director, and Oleg Fedorov, Head of the Department for Space Programs and Scientific Research. Joint cooperation between STCU and NSAU was discussed, including possible future areas of targeted cooperation.

STCU Visits the Kyiv Polytechnic Institute (KPI)

Mykhailo Zgurovsky, Rector of the Kyiv Polytechnic Institute (KPI), met STCU Executive Director Andrew Hood on 22 March and hosted a short tour of the university. Among the items discussed were possible KPI-STCU cooperation in jointly promoting innovative S&T development and beneficial technology transfer using STCU's project and sustainability development activities.

KPI is establishing a modern research park within the university, called Technopolis "Kyivska Politechnica", which will combine the functions of business incubator, technopark, research institutions, and faculties into a synergistic complex for S&T innovation and high-technology development for commercial applications.

STCU meets with World Bank Director

On 6 April Mr. Paul Bermingham, World Bank Director for Ukraine, Belarus, and Moldova, hosted a first meeting with STCU Executive Director Andrew Hood and EU Deputy Michel Zayet to discuss potential coordination between the Center and World Bank programs. With the goal of finding additional linkages to internationally funded assistance, the prospective collaboration could result in new avenues for scientific training and mutual benefits from exchanges of experience and knowledge.

22nd Governing Board Meeting, Kyiv, Ukraine

The Governing Parties – Canada, European Union, Ukraine, and the USA - held the 22nd Meeting of the STCU Governing Board on 18 May in Kyiv, Ukraine, approving over US$9.6 million and EURO 2.2 million in scientific research projects.

These include twenty-four (24) new Governing Party funded scientific projects for a total of US$1,953,497 and EURO 2,124,820; twenty-two (22) new Partner Projects valued at US$5,804,742 and EURO 108,520; and thirteen (13) Partner Project contract extensions valued at US$1,855,399 and EURO 11,243.

Second Annual "CNCP - Kazakhstan, Ukraine, Uzbekistan" Conference (Alushta, Ukraine)

On 23-25 May the Second Annual Closed Nuclear Centers Program "CNCP-Kazakhstan, Ukraine, Uzbekistan" Conference, sponsored by the United Kingdom Department of Trade and Industry (DTI), was held in Alushta, in Crimea, Ukraine.

The U.K. DTI aims to limit the spread of weapons of mass destruction by promoting sustainable civil sector employment for former nuclear weapons scientists in CIS countries. Since August 2004 CNCP, through the STCU Partners Program, has contributed over US$900,000 to create more than 100 new employment opportunities, including over 60 opportunities for former nuclear weapons scientists in Ukraine and Uzbekistan.

Technology Missions to Canada

In 2006, the Canadian Government sponsored a number of missions including the Advanced Manufacturing Workshop (June, 2006) and the NATO Advanced Workshop to Ontario, Canada (October, 2006). As a part of its efforts to integrate scientists and technical teams into the global scientific community, the STCU has provided recipient scientists the opportunity to travel to international conferences, advanced scientific workshops, trade shows etc. In addition to the technical program, these missions provide the scientists an opportunity to network and establish collaborative projects aimed at scientific discovery and / or technology commercialization.

MAJOR EVENTS AND ACCOMPLISHMENTS

Appointment of Vic Korsun as Deputy Executive Director (USA)

Vic Korsun was appointed as the new Deputy Executive Director (US) at the 22nd Governing Board meeting. Mr. Korsun is a technology manager with extensive expertise in a broad spectrum of technologies, including health sciences and diverse technologies, having worked on patents, licensing, start-up companies and business development. Mr. Korsun will lead the STCU's Sustainability Promotion Department.

STCU Bio Workshop "Positioning Bio-Institutes to Compete in Global Market" (Odessa, Ukraine)

An STCU Workshop, "Positioning Bio-Institutes to Compete in the Global Market," was held on 28-30 June in Odessa, attended by nearly 80 participants from major bio-institutes in Ukraine, Azerbaijan and Georgia, Western experts in bio-science and medicine, representatives from European, Canadian and US federal laboratories, and Western private companies.

Also attending were officials from the Ministry of Agrarian Policy of Ukraine, the State Administration for Pharmaceutical Products of Ukraine, the French National Defense General Secretariat, the European Commission's Directorate General for Research, and U.S. Defense Department's Defense Threat Reduction Agency.

STCU Workshop "From Science to Business", October 11-12, 2006

On 11-12 October in Kyiv, the STCU, together with NATO's Documentation and Information Center, co-sponsored the commercialization workshop "From Science to Business," attended by nearly 250 scientists from research institutes across Ukraine. The Workshop focused on research commercialization and best practices for Ukrainian scientists, and offered a platform for exchanges between foreign speakers, companies, institutes, and a large invited audience representing a broad spectrum of Ukrainian research. Key speakers from Canada, Europe, and the United States presented information to scientists on IPR protection, technology transfer, commercialization of research results, and attracting commercial financing.

The STCU Delegation Participated at the 14th BioPartnering Europe Conference (London, UK)

The event took place in October at the Queen Elizabeth Conference Center in London, UK. STCU supported four scientists from Kyiv, Lviv, and Dnipropetrovsk. STCU staff also organized more than 70 matchmaking meetings at the London conference. In addition, the STCU, in cooperation with the UK Department of Trade and Industry, prepared and conducted a number of meetings in Oxford with the various companies and organizations. This was the first STCU effort in the United Kingdom; STCU is working on follow- up actions.

STCU Round Table "Sustainability Efforts in IPMS: Evaluation of the STCU Targeted Training Program"

This event evaluated the effectiveness of the Targeted Training Program in the STCU's sustainability efforts. STCU Deputy Executive Director Vic Korsun briefed the Round Table participants on the importance of scientists' sustainability efforts and explained complicated issues in the technology commercialization process. STCU also presented new training materials for scientists.

Participants discussed STCU activities and future cooperation plans. In particular, scientists expressed their need for a Center for marketing research to provide targeted services to scientists from all over Ukraine.

Georgian National Science Foundation and the STCU Initiate Targeted Initiatives Program

On 31 October the Georgian National Science Foundation and the STCU signed a Statement of Cooperation initiating a Targeted R&D Initiative Program between the two organizations. This is the first extension of the successful STCU Targeted R&D Initiative Program to an STCU Recipient beyond Ukraine. The ceremony was attended by Alexander Didebulidze, First Deputy Minister of Education and Science of the Republic of Georgia.

MAJOR EVENTS AND ACCOMPLISHMENTS

23rd Governing Board Meeting, Kyiv, Ukraine

The Governing Parties – Canada, European Union, Ukraine and the USA held the 23rd Meeting of the STCU Governing Board on 16 November in Kyiv, Ukraine. Among its activities, the Governing Board approved funding for 28 new regular scientific projects, totaling US$687,869 and EURO 2,731,390, and confirmed 11 new Partner Projects and 11 Partner Project extensions, totaling US$2,323,531 and EURO 375,488.

As part of the STCU's Targeted R&D Initiative Program, the STCU Governing Board and the National Academy of Sciences of Ukraine (NASU) approved 10 jointly selected science projects totaling nearly US$1 million. These 10 projects will be co-financed by the Academy (US$500,000) and the STCU Financing Parties (US$354,076 and EURO 111,995).

STCU Participated in the National Ukrainian Exhibition (Chicago, USA)

On 14-16 December Deputy Executive Director (US) Vic Korsun participated in the Ukrainian National Exhibition in Chicago, USA. The Exhibition showcased over 50 Ukrainian companies in booths exhibiting their products for possible partnering and sales opportunities with US companies.

The STCU sponsored the Science and Technology Panel Session with participation by Academician A. Shpak, Vice President of the National Academy of Sciences of Ukraine, and other speakers.

For the full version of STCU News please visit
http://www.stcu.int/news/index.php

INFORMATION TECHNOLOGY ACTIVITY

The STCU Information Technology Group is responsible for maintaining and upgrading all STCU information technology and telecommunications equipment as well as the continued development of the STCU website, the Projects (Technical) Database, and custom software applications.

The new STCU website launched in 2006 represents a dramatic change to the function and look of STCU's online services. The new website provides a more market-driven approach to the presentation of STCU's information and activities. Along with changes in the website's overall function, the STCU IT Group designed a more flexible and user-friendly website; as a result, no critical information on the website is more then a few 'clicks' away. The STCU website provides authorized users with numerous online tools and functions that increase STCU productivity and efficiency, including online Regular Project Contract Approval, online Partnership Project Proposal Approval, and online Project document publishing. The IT Group also concentrated a great deal of its efforts in establishing the STCU website with the top World Wide Web search engines. Also through the efforts of the IT Group, the STCU was recognized by the Adobe Software Corporation as a not-for-profit government organization, reducing the cost of future Adobe Software purchases.

The IT Group hardware efforts were largely focused on increasing system redundancy, improving system reliability, and ensuring adequate storage space within the STCU computer network. These efforts, in conjunction with the purchase and installation of various rack mounted hardware accessories, have ensured the continued reliability and flexibility of the STCU computer infrastructure through 2007.

FINANCIAL ACTIVITY

The year 2006 saw a dramatic increase in the amount of new STCU project funding, reversing the downward trend started in 2004, and constituting the largest funding year in STCU's history. In 2006, the STCU Governing Board approved over US$19.8 million in new projects, an increase of approximately US$6.7 million in total new project funding from 2005.

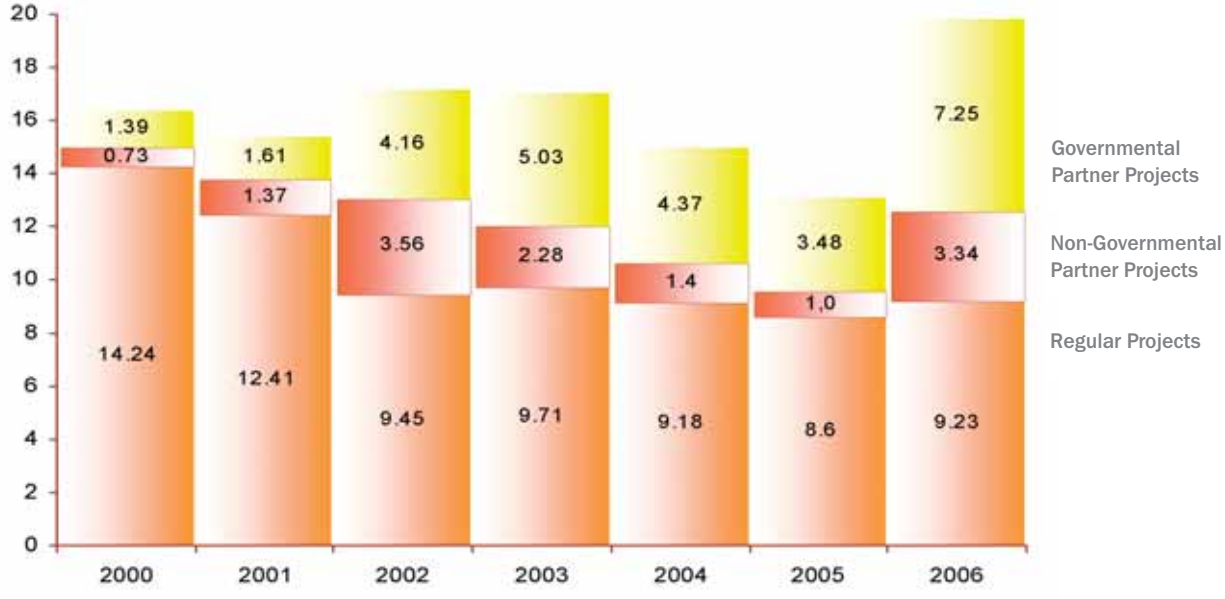
New Partnership Project funding in 2006 increased dramatically compared to previous years. The US$10.59 million in total Partnership Project funding approved by the STCU Governing Board in 2006 was the largest annual total in STCU's history. New project funding from all Partner organizations represented 53.4% of the total new STCU project funding approved in 2006. This was the first time in STCU history that the percentage of partnership funding was greater than all funding provided by STCU Funding Parties.

As in previous years, external auditors from both Lubbock Fine and the US Defense Contract Audit Agency audited STCU's financial management and accounting systems, as well as internal controls for both the operations of the STCU administration and STCU-funded projects. Lubbock Fine Chartered Accountants audited the December 31, 2006 financial statements, a copy of which may be obtained in the Document Center of the STCU website at: www.stcu.int/documents/stcu_inf/reports/audit/2006/.

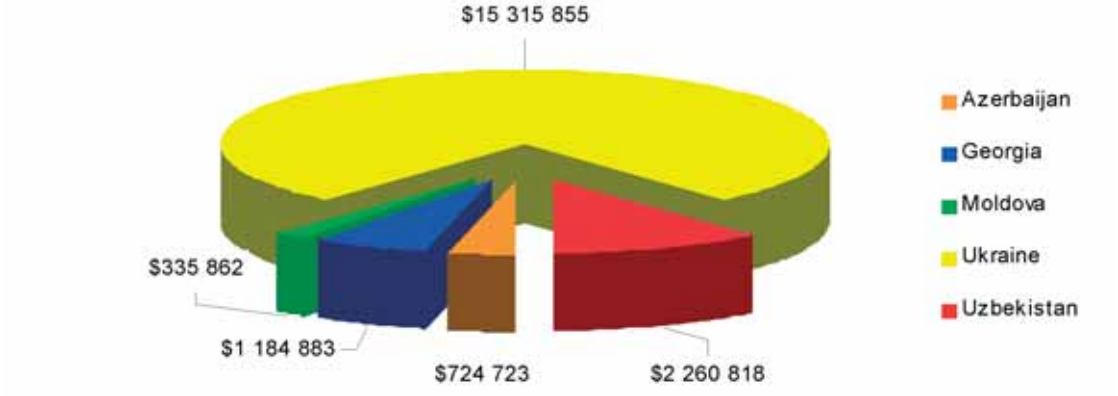
Some weaknesses were identified in conjunction with the December 31, 2006 financial statement audit and will be corrected during the course of 2007.

The Defense Contract Audit Agency audited twenty-three (23) projects during 2006, and worked closely with technical auditors from various organizations (i.e. Lawrence Livermore National Laboratory, University of Missouri-Rolla, and the U.S. Department of Energy) on most of these audits to produce both financial and technical project audit findings. The project audits performed by DCAA and the technical auditors identified only minor weaknesses which will be corrected during 2007.

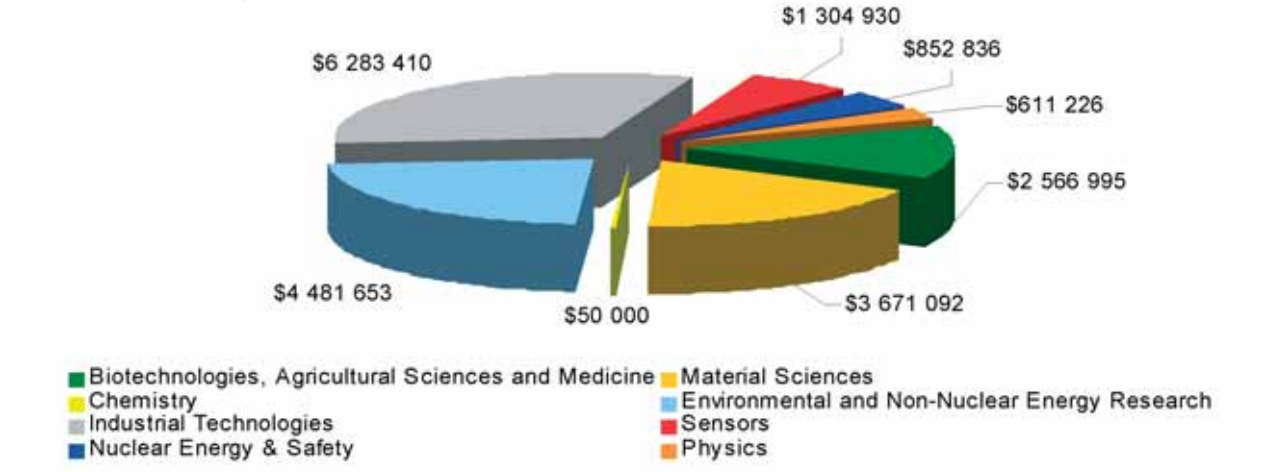
New Regular/Partnership Projects Approved for Funding, 2000-2006 (funding in millions US$/year)



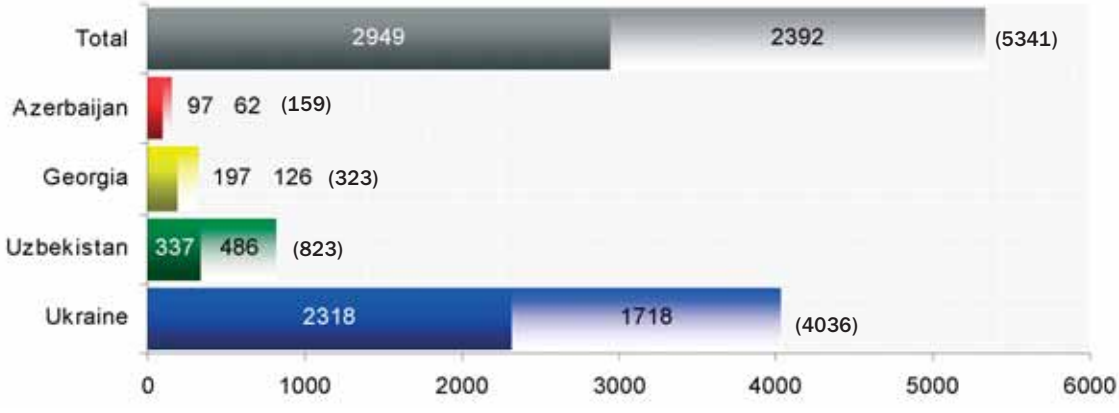
New Project Funding in 2006 by LOCATION OF RECIPIENT ORGANIZATION:



New Project Funding in 2006 by PRIMARY TECHNICAL AREA:



Participants Redirected to STCU Projects in 2006 by Country: (former weapon scientists / non former weapon scientists) (total):



AEROSPACE AND AERONAUTICS

On February 16, 2006 Yuriy Alexeev, the Director General of the National Space Agency of Ukraine, visited STCU and met Executive Director Andrew Hood and other STCU staff. Mr. Alexeev was accompanied by Eduard Kuznetsov, Deputy General Director, and Oleg Fedorov, Head of the Department for Space Programs and Scientific Research.

They discussed joint cooperation between STCU and NSAU, including some possible future areas of targeted cooperation: solid fuel utilization research, STCU cooperation with the National Space Agencies of Ukraine and of Georgia, and between the Academy of Sciences of Ukraine and National Science Foundation of Georgia. Mr. Fedorov highlighted the success of STCU-NSAU cooperation in S&T research for the mutual benefit of the participating organizations and countries.

Considering their mutual interest in cooperating in the development, utilization, and transfer of space technologies, NSAU submitted a proposal to organize a Technology Transfer Center (TTC). This proposal is under STCU consideration.

Project Activity

In 2006, four Partner Projects were approved (totaling US$321,198) in new aerospace materials development. This includes design of a new class of titanium alloys to manufacture parts and components operating under conditions of complex alternating loads. It is most effective to use such alloys to manufacture blades, discs, and other parts of gas turbine aircraft engines. These, as well as new composite materials based on polymer matrices and reinforced with high strength, preferentially graphite or paraamide fibers, became the major class of modern engineering materials for implementation into aircraft structural bodies.

One project approved in 2006 (STCU #3963) involves the Yuzhnoye SDO, the National University of Shipbuilding in Mykolayev, and the Georgian Technical University. Its objective is to develop an ecologically friendly technology that utilizes polymer bodies of solid propellant rockets. This project was financed for US$203,599 by the U.S. and includes scientific collaboration from the Earth Engineering Center of Columbia University.

Other Activities

In 2006 STCU was a co-sponsor of the United Nations/Ukraine Workshop on Space Law, "Status, Application and Progressive Development of International and National Space Law." The Workshop discussed the implementation of United Nations treaties and principles on outer space; legal aspects of commercialization of space activities; information exchange on national space laws and policies; and development of university level studies and programs in space law, with a view to promoting national expertise and capability in this field.

TECHNOLOGY FOR CONVERTING ROCKET PROPELLANTS INTO CIVIL INDUSTRY EXPLOSIVES

STCU project #1683 "The Development of a Technology for Processing Perchlorate Rocket Propellants in Civil Explosives" was completed in 2006. The project undertook a thorough study of the properties of solid perchlorate propellants to develop a technology to transform and produce emulsified explosives for mining. A hydro-jet wash-out technology for the solid propellant utilization was developed. The technology is ecologically pure and operates in a closed cycle, excluding water, soil, or air contamination. Known approaches, e.g. incorporation of ground propellants into water-based and emulsified industrial explosives, was implemented in addition to a newly developed technology to convert ammonium perchlorate into ethanolamine perchlorate. The project resulted in creating an opportunity for solid perchlorate propellants use as a source material for cheaper civil explosives.

HIGHLIGHTED TECHNOLOGY

NANOSATELLITE FOR ELECTROMAGNETIC MEASUREMENTS

Description

A nanosatellite is a new, inexpensive mobile instrument for electromagnetic environment study near the International Space Station (ISS). The instrument can measure, store, and transmit to the base station various data:

- three components of the constant magnetic field in the range ±65000 nT;
- variations of magnetic field in the
  - frequency range of 0.1 ...40000 Hz;
  - electric potential in the frequency range of DC...40000 Hz;
- the current density in the frequency range of 0.1 ... 40000 Hz;
- kinetic plasma parameters – temperature, concentration, and velocity of the charged and neutral particles.

Innovative Aspect and Main Advantages

The instrument design is based on an inexpensive industrial single-board PC using the LINUX operating system. It has low-power sensors with high metrological characteristics that provide

- low cost;
- low power consumption;
- small physical dimensions and weight;
- possibility of rapid modernization.

Areas of Application

- Equipping the ISS to monitor its surface electric potential and electromagnetic environment.
- With minor changes in the nanosatellite, it could be used as a fully autonomous measuring system for both space and ground applications.

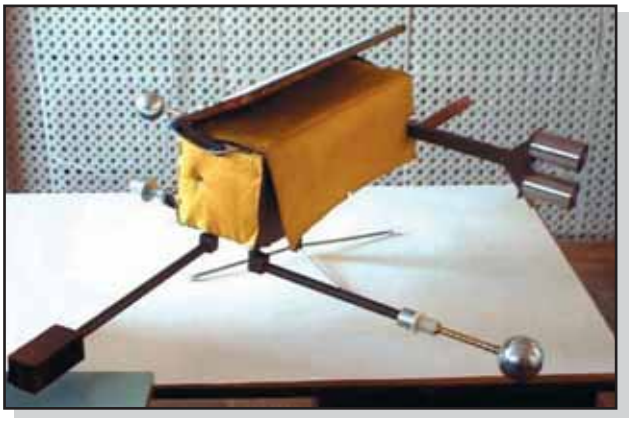


Fig.1 Nanosatellite for electromagnetic measurements

Stage of Development

An engineering model was tested under laboratory conditions. A group of sensors passed tests in a plasma-dynamic vacuum chamber under conditions close to operation requirements.

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STCU Project # NN 38
Financing Party: the USA (US$ 150,000)

BIOTECHNOLOGIES, AGRICULTURAL SCIENCES AND MEDICINE

In 2006 the STCU Projects continued to focus on medical equipment and tools, biotechnologies for environment and agriculture, diagnostics and test systems, biodiversity, medical/veterinary preparations, and drug design.

Project Activity in 2006

STCU added 10 new projects for a total active portfolio of 65 projects in this field. Twenty of these projects were successfully completed and resulted in marketable technologies and perhaps marketable products including:

- multi-modality imaging technology (project #1931),
- piezoelectric micromanipulator for in-vitro fertilization (IVF)-technologies (project #3015),
- high-dispersed compositions for the optimization of reproductive cell media (project #3103),
- computer system for drug design and selection of effective anti-herpetic preparations (project #3147),
- technique for ultrasonic correlation and non-linear defectoscopy and medical introscopy (project #Ge-51),
- collection of extremophilic mycelial fungi isolated from all ecological niches of the Caucasus (project #Ge-101).

Also some active Partner Projects received additional funds for extended research work. In particular, the U.S. Department of Energy's Initiatives for Proliferation Prevention Program prolonged two Partner Projects (#P194 and #P196) for a third year of funding in microbial diversity research by the Durmishidze Insitute of Biochemistry and Biotechnology (Georgia), at the request of Lawrence Berkeley National Laboratory.

Also, the U.S. Department of Agriculture's Agriculture Research Service prolonged four Partner Projects in Uzbekistan and thus contributed to advancing agricultural technologies in that country.

In 2006, the U.S. Department of Health and Human Services/Biotechnology Engagement Program (DHHS/BTEP) became an active STCU Government Partner and plans are for BTEP projects to begin in 2007.

Other Activities

- The STCU led several delegations of scientists from the Recipient Countries to participate in major biotech events, including BIO2006 in Chicago, 9 – 12 April and the workshop "Optical Waveguide Sensing and Imaging in Medicine, Environmental, Security and Defence," held in Gatineau, Quebec, Canada, 12-21 October
- Several workshops and symposiums were arranged with the financial support of STCU including "Positioning Bio-Institutes to Compete in the Global Market" held in Odessa, 28-30 June 2006 and Ukrainian-German Symposium on Nanobiotechnology held in Kyiv, 14-16 December.

INFORMATIONAL TOOLS FOR ASSISTANCE OF SONOGRAPHIC EXAMINATIONS

The first STCU project in Moldova commenced in 2006 and involves development of advanced information tools to assist in medical imaging diagnostics and diagnoses. STCU Project #4035 was financed by EU for EURO 173,000. In order to obtain quick and correct information about specific diseases the project develops a unified diagnostic system that allows image storing and providing image annotation information based on medical records and medical descriptions. This guides ultrasound device operators to narrow and justify their medical diagnosis. The approach encompasses: medical descriptions, pathologies, and anomalies of the organs; knowledge acquisition methods based on ultrasound investigations characteristics; diagnostics validation tool; image clustering and fuzzy processing algorithms; database model for medical images, including annotations and "fuzzy" information storing; quick database searching algorithms; knowledge database; an ergonomic and user friendly interface. The proposed informational tools aim to offer combined solutions based on image classification and rules-based decision making.

HIGHLIGHTED TECHNOLOGY

PLANT GROWTH REGULATORS OF A NEW GENERATION

Description

A number of new generation plant growth regulators (PGR) characterized by high efficiency was created in Ukraine. They promote plant stability to illnesses and pests, a lower percentage of nitrates, heavy metal ions and radionuclides in products, and a reduced (by a factor of two) mutagenic effect of pesticides.

New PGRs are created by cultivating fungi-micromicetes extracted from the plant root system . The created regulators positively influence on the development of root system, soil microflora, the sizes of leaf surface are increased, photosynthesis is intensified, stability to stresses (frost, drought, salinity etc.), harvest and its quality are promoted.

Innovative Aspect and Main Advantages:

- PGR use in biological agriculture.
- Reduction of power inputs on the cultivation of unit production.
- Rise of biocenosis stability to illnesses, pests, and other stress factors.
- Improvement of plant production.

Areas of Application:

Technologies of the PGR application coincide with the existing methods of pre-sowing seed treatment and spraying of sowing for more than 30 cultures. Technologies in dendrology, forestry, growing of mushrooms, biotechnology of bacterial fertilizers are developed.

Rate of preparations application amounts 10-20 ml per 1 ha (10.000 m^2) at the cost US$2-7 and the increase of productivity on 15-25 %. One US$ taken up in the technology is repaid with US$ 10-20 of additional production.

Stage of Development:

- The complex of researches of action mechanism at a cellular level is executed;
- Toxicology, hygienical researches are conducted;
- Technologies of application are developed;
- PGR are registered in Ukraine and some other countries;
- Research production is organized;
- Patents of Ukraine, Russian Federation are taken out.
- We are ready to joint researches, licensing, marketing.

Pic.1 Result of the PGR application on a winter wheat in Germany

Pic.2. Process of micromycets inoculation in the laboratory.

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STCU Project # 3028
Financing Party: the USA (US$ 180,000)

MATERIALS SCIENCE

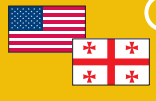
In 2006, the STCU approved 13 Regular Projects for funding in materials science area, totaling approximately US$ 1.13 million and EURO 930,181. Moreover, in 2006 the STCU approved 5 projects for funding selected under the second call of proposals of the Targeted R&D Initiative between STCU and the National Academy of Sciences of Ukraine in the area of Nanotechnologies. The STCU project # 4120 (US$ 99,976), for example, was financed one-half by NASU and the other half from shared contributions of Canada, the EU, and the USA. This project will develop novel semi-conductor nanomaterials for thin-film solar cells based on complex chalcogenides which could improve the characteristics and prices of photovoltaic solar cells.

Also approved in 2006 were 11 Partner Projects in the materials science field, totaling approximately US$ 573,864. Among these was Partner Project #P200b, financed by US Department of Energy's Initiatives for Proliferation Prevention Program (US$ 50,000). The project will be carried out at the laboratories of Institute of Organic Chemistry, Ukraine and Kyiv Taras Schevchenko National University. The project team will synthesize about 50-60 novel heterocyclic and fluoroorganic compounds ordered by the partner during fulfillment of the project. It is expected that 25 new heterocycles (250mg each) will be derived from this research efforts including detailed synthetic procedures and comprehensive analytical data.

Other Activities

During 2006, the STCU sponsored five conferences in materials science in Ukraine and Georgia and supported travel grants of Ukrainian scientists to participate in the international conferences abroad.

On 11-12 October the STCU-NATO Workshop "From Science to Business" organized a panel on problems and prospects of new materials and nanotechnology that discussed innovative technologies and their potential commercialization. Ukrainian scientists submitted more than 50 Technology Profile Forms (TPFs) and the best seven TPFs were selected for oral presentation. The discussion showed that nanotechnology science now places a special emphasis on nanomaterials with conductor, semiconductor and liquid crystal properties, as well as on functional materials for extreme conditions. One STCU poster was presented at the International Conference "Trends in Nanotechnology TNT 2006" held on 4-8 September in France.

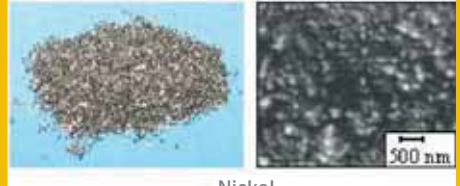


PRODUCTION TECHNOLOGY OF ULTRADISPERSED AND NANOMETRIC POWDERS

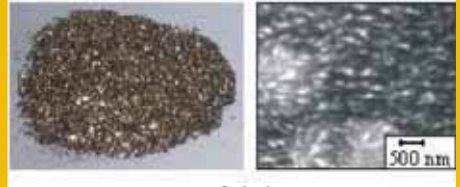
SUCCESS STORY

The physical processes of evaporation and vapor condensation constitute a unique technological complex that gives unlimited possibilities to create solid body structures. Therefore within the current STCU project #GE-111 of the Georgian Technical University, an electron beam technology for production of powders will be created. The technology will not require any preliminary treatment of the starting materials. Focused electron beams enable the evaporation of most refractory elements and chemical compounds and these give free choice of starting materials. Application of water-cooled copper crucibles and carrying out the process under vacuum ensures high purity of vapor stream. Vacuum technology enables to charge powders into special containers, and to pressurize them under vacuum in one technological cycle. Powders of some metals, e.g. nickel and cobalt do not require additional measures of passivation and pressurization.

The developed nanoscale powders have commercial potential in micro and nanoelectronics, medicine, nuclear power generation, space technology, machine-building industry.



Nickel



Cobalt

HIGHLIGHTED TECHNOLOGY

DIAMOND POLYCRYSTAL NANOCOMPOSITE

Description

At present one of the most important research areas in the development of superhard materials with new physico mechanical properties is the use of initial nanodispersed materials. Under adequate conditions, a unique complex of mechanical properties, e.g., a combination of solidity and fracture toughness, can be realized in a nanodispersed polycrystal.

In developing production technologies of novel superhard materials using initial nanomaterials, the retention of the material nanodispersed state in the course of sintering is an important problem. In addition, mechanical properties are highly structure-sensitive, which is particularly distinct in using nanomaterials.

Diamond nanopowders can be prepared for high temperature compacting before sintering. Research results have allowed the development of optimum conditions of production of tool materials based on the diamond nanopowders.

Innovative Aspect and Main Advantages:

It is experimentally proved that the most efficient approach to the improvement of physico-mechanical properties of diamond polycrystals produced from nanopowders is a search for the optimal conditions of sintering of mixtures containing additions acting as solvents for carbon (Co, Ni, Fe, alloys of them, etc.) and as inhibiters of the grain growth. The use of high-pressure techniques in combination with purification and vacuum degassing for sintering of statically synthesized diamond nanopowders favors the formation of nanostructure elements of 10 to 50 nm in size in a polycrystal. Preactivation of the initial statically synthesized diamond nanopowders using cold isostatic pressing has allowed the production of polycrystals with a density of 3.31 g/cm^3,Vickers hardness of 35.4 GPa (P = 9.8 N) and fracture toughness K1c = 6.8 MPa.m1/2.

Cutting plates, drawing die and cutting tool

Areas of Application:

Tools made of the composites of statically synthesized diamond nanopowder can successfully compete with single-crystal natural diamond tools. The composites may be used for making variously purposed cutting, deforming or measuring tools and, thanks to high fracture toughness, the composites may be used as inserts in drilling tools. Now the samples of the instrument are tested in construction.

Stage of Development:

Prototype available for testing

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STCU Project # 1745
Financing Parties: Canada and European Union (US$ 121,537)

CHEMISTRY

In 2006, STCU projects in chemistry focused on conducting both fundamental and applied research including nanochemistry research of substances and processes, chemical ecology, and development of high-effective chemical processes in biologically active materials and substances. These priority areas were encompassed within the Ukrainian National Academy of Sciences' targeted program "Fundamentals of creation of new substances and materials and physical-chemical principles of chemical reactions' control". STCU projects that received financial support in 2006 actively participated in development of scientific principles for creation of molecular basis of magnetic media; development of composite ceramic materials on the basis of 3d metals with high stability level and synthesis of new heterocyclic and fluoro-organic structures.

Project Activity

In 2006 STCU funded four new projects in chemical priority areas totaling US$ 481,271 and EURO 33,785. One of them, STCU Project #3594, initiated by the Institute of Organic Chemistry (Kyiv), is dedicated to the design of new catalysts which are similar to natural enzymes in efficiency or selectivity. Another project, STCU Project #4140, being implemented by the Institute for Condensed Systems Physics (Lviv), develops theoretical and practical principles of modern technologies for the predictable synthesis of reactive polymer, mineral and hybrid nanoparticles with predetermined functionality and reactivity for their commercial application.

The A. S. Sadykov Institute of Bioorganic Chemistry, Uzbekistan, implements an STCU Partner Project (financed by U.S. Department of Agriculture) analyzing biological properties of gossypol-related compounds in cottonseed glands, and related compounds formed as the result of seed storage. The project, when completed, may also suggest seed conditioning strategies for reducing cottonseed toxicity, and will be of great importance for producing gland-free or low-gossypol cottonseed meal products.

Other Activities

In 2006 STCU supported two scientific conferences: the Xth International Conference "Hydrogen Materials Science and Chemistry of Carbon Nanomaterials" in Ukraine and the 15th Conference "Physical Methods in Coordination and Supramolecular Chemistry" in Chisinau, Moldova.

Under the STCU Patenting Program, Dr. Leonid Golovko from the Institute of Bioorganic Chemistry and Petrochemistry (STCU Project #1310) received an STCU Patent Grant to obtain an international patent under the Patent Cooperation Treaty. This international patent application combined three Ukrainian patents that STCU had supported previously.

HIGH VALUE COMPOSITES FROM TIRE RUBBER AND POLYOLEFIN WASTES

A new, effective method for producing thermoplastic dynamic vulcanizates (TDVs) from polymer wastes was developed under STCU Project #3009 (financed by UIE for EURO 252,000) by the Institute of Macromolecular Chemistry (Ukraine) jointly with the Institute of Nuclear Physics (Uzbekistan). This method proposed thermal, mechanical and chemical reclamation of crumb rubber (viz. ground tire rubber, GTR) and its reuse in combination with recycled polyolefin wastes to produce composite materials. High performance of TDVs produced from recycled polyolefins and GTR is achieved through discontinuous (inner mixer) and continuous (extrusion) production methods. The TDVs of optimal composition are characterized by high tensile strength (12-13 MPa), high elongation at break (500-800%), high thermal, frost, ageing and chemical resistance, as well as high stability to multiple reprocessing.

HIGHLIGHTED TECHNOLOGY

OXYGEN – CONTAINING ADDITIVE AS AN ECOLOGICALLY BENEFICIAL COMPONENT OF INTERNAL COMBUSTION ENGINE FUEL

Description

The main drawback of oil and gas derived fuel burning in internal combustion engines during vehicle operation is the high emission of harmful particles into the environment, mainly carbon dioxide, nitrogen oxide, lead, sulfur oxide, and unburned hydrocarbons.

Polycyclic aromatic hydrocarbons (benzene, toluene, alkyl-benzene) in emissions is often 2-3 times higher than that allowed by the maximum concentration limit (MCL). Another aspect of internal combustion engine system imperfection is wear and tear, which results in smut, lacquer buildup, and increased exhaust smoke.

Specialists of the «Clean Service» developed scheme of the use of alternative fuel types and systematized on ecological efficiency.

Innovative Aspects and Main Advantages

The main advantages of joining of the oxygen-containing additive with diesel fuel were:

- Exhaust smoking actually disappeared and carcinogenic diesel smut in combustion chamber is not generated;
- Consumption of diesel fuel with additive was decreased by 21-22% (of the total volume) depending on working load of the tractor;
- Controlled growth of engine power;
- The cost of diesel fuel with oxygen containing additive is 3-5% lower than the cost of the pure fuel.

Area of Application

All internal combustion engines for work on the alternative fuel types.

New type of coatings on the combustion engine pistons.

Concentrate of oxygen-containing additive

Stage of development

Additives were pre-checked on the tractor "IOM3/6AKJT" in "Agro Soyuz", which is one of the leading enterprises in the Ukrainian agricultural sector.

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STCU Project # 3527
Financing Party: the USA (US$ 191,399)

ENVIRONMENTAL RESEARCH

In 2006 STCU project activities continued to address environmental and energy research issues.

Project Activity

STCU approved eleven regular projects in this area with a total funding of US$ 460.984 and 1053.661EURO. Among these projects is STCU #3643, from the Institute of Macromolecular Chemistry (Ukraine), Institute of Organic Chemistry (Ukraine), and Institute of Semiconductor Physics (Ukraine), financed jointly by the US and EU for more than US$ 320,000. The project focuses on rapid, on-site detection of harmful, persistent organic pollutants, toxic volatile compounds, and other dangerous substances in the environment. A combination of a highly sensitive calixarene-based sensor array and nanoorganized functional layers allows reliable and low cost identification and quantification of hazardous materials in the air, water, and soil. This instrument can also successfully be used to detect terrorist threats.

Also in 2006, six Partner Projects related to the Environmental and Non Nuclear Energy Research area were funded, totaling US$ 2.17 million. Among them was project #P-201a, extended for one year by the U.S. Department of Energy's Initiatives for Proliferation Prevention Program, devoted to renewable energy sources, in particular to direct conversion of solar energy into electric power by semiconductor based photovoltaic (PV) solar cells. A US Industrial Partner has achieved the highest ever produced efficiency for silicon cells used in commercial PV modules, but the cost of their production is still high. More power can be generated with the same amount of solar cells using plastic concentrators (Fresnel lenses (FL), but polyacrylic FL are subjected to environmental and weathering – induced degradation. To protect FL, a high-performance coating technology will be developed at the Kharkiv Institute of Physics and Technology to reinforce the large area FL by condensing an aluminum plasma flow on the polyacrylic substrate in nitrogen ambience. Another Partner Project was initiated in cooperation with the US Environmental Protection Agency (EPA). The STCU Project #P-277 is a US$ 395,000 project with the Ukrainian Institute of Biology of Southern Seas, in partnership with the Institute of Hydrobiology, the Institute of Colloid Chemistry and Water Chemistry, and the Institute of Organic Chemistry. The project objective is to evaluate the causes of observed impairments in Ukrainian estuaries using the diagnostic approach and tools developed by the U.S. EPA.

ESTABLISHMENT OF A SERIAL PRODUCTION AND MARKETING OF WATER PURIFICATION DEVICES IN UZBEKISTAN

Access to clean, secure drinking water is critical in Central Asia. Uzbekistan, the region's most populous country, has some of the worst-quality ground water due to the effects of Soviet-era weapons research and development as well as other environmental factors.

The Institute of Nuclear Physics of the Uzbekistan Academy of Sciences has developed water purification/disinfection/desalination devices for collective and individual use. They have been tested in international laboratories and patented and certified in Uzbekistan, South Korea and Russia.

The UK's DTI Closed Nuclear Cities Partnership Program financed an STCU Partner Project #P265 (US$ 180,000) at the Institute of Nuclear Physics devoted the serial production of household and industrial water purification devices that will meet the needs of many Uzbeks.

HIGHLIGHTED TECHNOLOGY

ENVIRONMENTALLY FRIENDLY GASIFICATION OF MUNICIPAL SOLID WASTES

Description

Environmentally friendly gasification technology for processing of municipal solid waste (MSW) is proposed. The technology allows to treat MSW effectively and to obtain medium-calorific producer gas with minimal negative impact upon environment. Twin fluid bed gasifier consists of two fluid bed reactors – gasifier itself and combustion chamber – connected with each other by a chute.

Steam gasification takes place in the gasifier; sand is an inert material of the bed. Sand is heated in combustion chamber at the expense of burning of char coming from gasifier through chute. Heated sand goes back to gasifier. The construction of the unit is suitable for further scaling up so that the technology is brought to demonstration level and then to commercial application.

Innovative Aspects and Main Advantages

The proposed gasification technology has advantages over other types of gasifiers as well as over other thermochemical processes for MSW treatment such as combustion and pyrolysis, namely:

- low formation of dioxins and furans due to optimal construction of the gasifier and combustion chamber;
- comparatively simple gas cleaning system;
- low negative impact upon environment;
- compacting effect from gasification is much more than that from pyrolysis. Unburned charcoal remains after pyrolysis while only ash remains after gasification;
- gasification is a less power-consuming process than pyrolysis;
- as gasification takes place under limited amount of oxygen, formation of dioxins is much less intensive than during direct combustion of MSW;
- due to lower temperature during gasification as against combustion, formation of NO_x is also much less intensive.

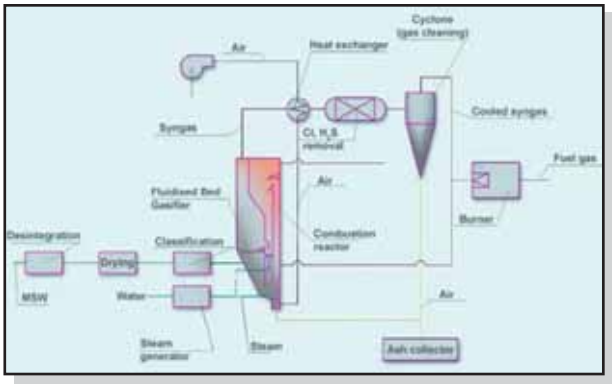

Fig. 1. Layout of a 50 kW twin fluid bed gasifier.

Area of Application

The installation can be used by municipalities or landfill operators for MSW utilization. As producer gas is of high quality the unit can be equipped with gas engine for power production.

Stage of development

A 50 kW experimental unit has been constructed and investigated in the laboratory. Detail design and design documentation is available. The unit can be scaled up to 5 MWth without significant problems.

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STCU Project # 3036
Financing Parties: Canada and EU (US$ 120,630)

SENSORS

Project Activity

STCU sensor related projects in 2006 focused on of mechanical, electrical, microwave, radar, semiconductor, thin film, surface, optical, biological, bio membrane, and their combinations.

In 2006, STCU approved five Regular Projects with total funding of approximately EURO 594,045. One of these Regular Projects (STCU #3377) involves the Institute for Radiophysics and Electronics of NASU and its research related to the metrological support of precise radar measurement. The Lviv Polytechnic Institute is involved in the International Thermonuclear Experimental Reactor (ITER) program for R&D of magnetic field sensors. These magnetic sensors can operate under thermonuclear plasma. Two STCU Partner Projects for US$523,505 and EURO 28,000 were approved in 2006.

Other Activities

In 2006, STCU supported six international conferences where sensor project results were reported or presented. The international level of those STCU supported events confirms the high quality of the STCU sensors projects and opens new possibilities for international collaboration of former weapon scientists.

In 2006 the Canadian Ministry of Foreign Affairs supported a mission of Ukrainian scientists to participate in the NATO Advanced Study Institute on Optical Sensing and Imaging, October 12 21, in Gatineau, Canada. The Ukrainian scientists were able to acquire information on photonics and its applications for bio and nanobio-sensing, and to establish new collaborative relationship. This mission was very important to meet current STCU desires for institute self-sustainability

STCU also provided financial assistance for a Ukrainian patent application for a sensor technology developed in an STCU project.

AZERBAIJAN AND GEORGIAN SCIENTISTS DEVELOP IR SENSORS

STCU Project # 3641, "The creation of the dielectric state in the narrow band gap IV VI semiconductors," is a joint Azeri-Georgian project. Financed by the U.S. for US$ 386,500, it supports potentially significant research in semiconductor technologies that could be used to develop different photo detectors, semiconductor nuclear and gas and liquid chemical sensors or detectors. The developed technologies could be used for advanced IR detectors for astrophysics, aerospace, and thermo vision systems etc. The project includes market research for future sustainability.

HIGHLIGHTED TECHNOLOGY

MINIATURE BIOSENSOR FOR DETECTION OF GLUCOSE AND LACTATE IN BLOOD

Description

This is a sensitive, low-cost biosensor for glucose and lactate level detection in blood, based on carbon nanotubes emission. This technology utilizes the NIR luminescence of semiconducting single walled carbon nanotubes bound with recognizing biosystems (glucose oxidase, lactate oxidase). For this purpose using small diameter nanotubes (0.6-1.1 nm) are preferable because its emission can be detected in the spectral range 0.9-1.2 mkm by a conventional low cost CCD matrix or photomultiplier. In this spectral range human tissues are optically transparent and a sensor can be implanted into the body. The central issue in designing and forming such devices is a creation of the interface between the nanotube and the recognition biosystem. To avoid loss of intrinsic nanotube properties upon chemical modification, a noncovalent nanotube functionalization will be applied. In this R&D, two approaches are rised to functionalization small diameter nanotubes. First, a chemical compound whose flat part couples with the nanotube surface by means of the interaction and with the linker immobilized by the enzyme will be identified and synthesized. Another possible approach to the non covalent nanotube functionalization is using polymer wrapping around the tube. A method of enzyme immobilization on polymer wrapped nanotube will be developed.

Distinctive features of proposed R&D

- noncovalent functionalization of smalldiameter nanotubes by specially synthesized chemical compound;
- efficient enzyme immobilization on small diameter noncovalent functionalyzed nanotubes;
- application of conventional CCD matrix or photomultipliers for emission detecting.

Innovative Aspect and Main Advantages

An important advantage of the glucose and lactate sensors is the possibility of implanting the sensors directly into the tissue and using them for continuous monitoring. Proposed glucose and lactate sensor will detect optical signal in the near infrared spectral region where human tissues are optically transparent. Such a biosensor does not require outside power to operate and the information from the sensor can be obtained by means of wireless communication.

Areas of Application

Medicine, veterinary.

Stage of Development

The biosensor is under development.

Influence of glucose level in aqueous solution on the nanotubes emission intensity was tested. It was found out that enzyme immobilized on DNA wrapped nanotubes keeps its native activity.

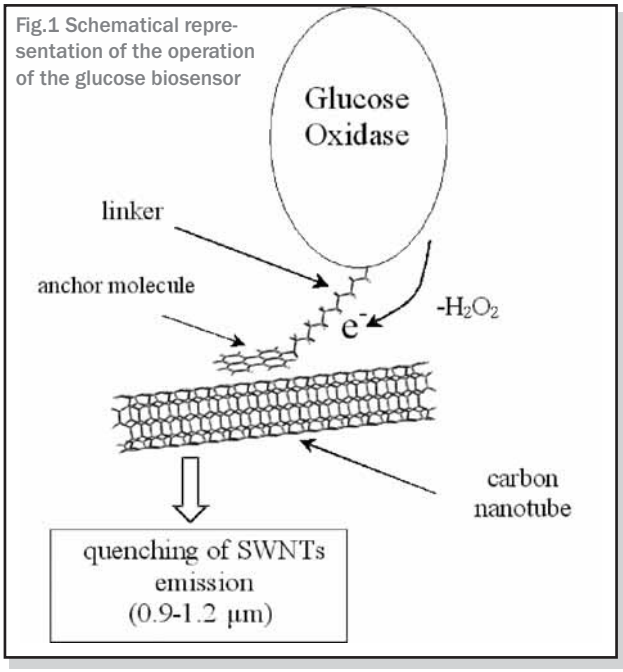

Fig.1 Schematical representation of the operation of the glucose biosensor

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STCU Proposal # 3751

INDUSTRIAL TECHNOLOGIES

The area of Industrial Technologies according to the STCU classification includes welding and metallurgy, as well as communications infrastructure, experimental industrial technologies and information technologies. So far it is most significant part of applied research and development work in STCU activities: out of total amount of 1050 projects funded by the STCU during last decade almost one third (287 to be exact) are Projects in Industrial Technologies area.

Project Activity in 2006

STCU financed 23 regular projects in Industrial Technologies totaling approximately US$1.08 million and EURO 1,75 million. Among these was STCU Project #3569, a US$360,000 project "Micro- and macro-reinforcement of asphalt concrete pavement with fibrous materials made in Ukraine and their waste". This project was financed by the United States and will be performed by three Ukrainian institutes led by the Institute of Macromolecular Chemistry together with Azerbaijan's Institute of Polymer Materials, Sumgait. Another interesting example is project #3868 "Application of methods and means of electronics and automatics in systems of selective tea gathering". This project is financed by the EU on total amount about EURO 95 K and will be fulfilled by Institute of Cybernetics of the Georgian Academy of Sciences.

In addition, 24 new Partner Projects plus 9 Partner Project extensions totaling almost US$ 5 million and EURO 465, 251 were approved. Included in these was a US$ 1,260,000 Partner Project financed by the U.S. Company to develop electron beam welding machine for drill bits manufacture. Also U.S. Department of Energy's Initiatives for Proliferation Prevention Program and the Paton Electric Welding Institute started Partner Project to develop protective coating technologies for gas turbine engine airfoils.

Other Activities

The VIII International Conference and Exhibition "Problems of Corrosion and Corrosion Protection of Structural Materials" organized by Karpenko Physical-Mechanical Institute in Lviv was supported by the STCU. In addition, STCU supported International Workshop "Problems of automated recognition" organized by State Scientific Research Institute of Information Infrastructure in Lviv. Also the 1st International Conference on Computer Science and information Technology organized by Lviv National Polytechnic University was supported by the STCU.

AZERBAIJAN SCIENTISTS DEVELOP NANOSTRUCTURED SHAPE MEMORY INTERMETALLIC COMPOUNDS

STCU Project #3520 (financed by the U.S. for US$ 263,000) is devoted to nanostructured shape memory intermetallic compounds with enhanced transformation temperatures. The (TiZrHf)(NiCuMe) melt-spun ribbons and twin-roll strips with controlled grain size and small size dispersion have been obtained from initially amorphous state by appropriate heat treatments. Pre-alloyed TiNi-base powders have been obtained by the electric-spark erosion technique providing solidification rates of 106–109K/s from liquid and vapor states. Ni-Mn-Ga-X alloy powders by electric spark erosion and ultrasonic assisted severe plastic deformation by ball milling are also envisaged. Details of the processes used and enhancement of shape memory properties due to the nanoscale crystals formed from supercooled metallic liquid or broking microstructure dawn into nanostructured are being studied.

Grain size controlled shape memory alloys with high transformation temperature have high potential for use in automotive and air-space industries. Natural refinement of the parent phase microstructure helps to improve the mechanical properties (to increase strength) and thus fulfill the requirement of thermoelastic phase equilibrium, superelasticity and shape memory accompanying martensitic transformations at increased temperatures.

HIGHLIGHTED TECHNOLOGY

ENERGY SAVING AND ENVIRONMENTALLY FRIENDLY EQUIPMENT FOR SEPARATION OF THE METAL CORD AND RUBBER IN THE USED AUTOMOBILE TIRES

Description

The method of separation is based upon the passage of electric impulses in the wires of the metal cord of the tires. Due to a combination of mechanical and thermal effects this gives a clean separation of the metal wired cords from rubber.

The electro-pulse equipment creates a series of powerful short duration electric impulses. The equipment includes charging, storage, discharging and technological units. The design of the equipment has modular approach. The module basic characteristics are: stored electric energy 8-12 kJ, working voltage 3-10 kV, time between impulses 10-60 sec, duration of impulses (initial period of decaying oscillations) 50-100 μsec. Power supply is from ac network 220 V or 3x380 V. The installation may contain from 1 to 30 modules.

Innovative Aspect and Main Advantages

The technology has no analogs in the world (that is confirmed by several patents) and provides both exceptionally clean (brass coating being kept intact on the metal cord) and environmentally friendly metal separation (the rubber temperature becomes higher only on 10-200 C). Also the power consumption is minimal. The electro-pulse equipment provides impulse characteristics not used before (the ratio of discharge current and energy in an impulse is up to 0.5 MA per 10 kJ for one module). This provides the minimal losses of energy in the process of separation of the metal from rubber (0.01-0.02 kWh/kg of tyre weight).

Areas of application

The equipment can be used in existing tyre recycling lines. The full separation of metal cord at the first stage leads to the saving of power consumption for the recycling process in whole, to the considerable reduction of the wear of mechanical components, as well as clean metal and rubber are obtained without any waste. The productivity of the electro-impulse equipment practically is not limited

Stages of development

The equipment and technology are protected by:

- United States Patent No. US 6,391,930 B1,
- Canadian Patent No.2,327,272,
- Patent of the People's Republic of China No. 100774,
- The Patent of the Russian Federation No. 2139188,
- The Patent of Ukraine No. 26176.

The electro-impulse equipment can be produced under contract with the client. The auxiliary mechanical equipment demands additional development and a binding to recycling lines.

Eight-modular installation, 70 kJ.

Fragments of the used tyres after electro-impulse processing

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STCU Proposal # 2452, #3318

NUCLEAR ENERGY AND SAFETY

Project Activity

In 2006, the following STCU Regular Projects were active in the area of Nuclear Energy and Safety:

• STCU Project #1719 "Increase of Operational Resource for Nuclear Industry Applications" (financed by the US for US$129,500) was performed by scientists of IVL Equipment & Engineering, Ltd., delivering a top-level scientific and methodological document covering the safety impact of aging on key nuclear reactor components and structures as well as reactor life-extension issues prepared for Ukraine's nuclear utility (EnergoAtom) for the development of Safety Analysis Reports on the basis of which operating licenses are granted to nuclear power reactors.

• STCU Project #1706 "Development Of The Sorption-Barrier Materials On The Basis Of Clay Stuff For Radionuclides Sorption" (co-financed by the EU and U.S. for US$124,400) saw Ukrainian scientists from Lviv Polytechnic Institute, Institute for Condensed Matter Physics, and the State Specialized Enterprise "Technocenter" determine the optimal composition of carbonate-containing clay-based sorption-barrier materials for use as radio-ecological barriers to inhibit and block the migration of radionuclides to water-bearing layers in radioactively-contaminated areas.

• The joint Ukrainian-Uzbek STCU Project #UZ-54 "Spectroheliograph for Real—Time Registration of the Solar Activity (SRSA) in Different Spectrum Lines" (financed by the U.S. for US$135,000) saw the Uzbek Ulugh Beg Astronomical Institute and the Ukrainian Usikov Institute of Radiophysics and Electronics join forces to establish the basis for a unified system for monitoring solar activity that will significantly expand the capacity to gather information on solar processes.

• STCU Project #UZ-87 "Studies of the Effect of Neutron Irradiation on Physical & Mechanical Properties of Aluminum Claddings" (financed by the U.S. for US$200,000) had scientists of the Uzbek Institute of Nuclear Physics investigate the effect of neutron irradiation on the physical and chemical properties of aluminum cladding of nuclear fuel rods, to optimize design and operational parameters of nuclear power reactors and spent fuel storage facilities.

In Partner activity, one small Partner Project (STCU Project #P244) was financed by the U.S. Pacific Northwest National Laboratory to have scientists of Ukraine's Kharkiv Institute of Physics and Technology investigate nuclear resonance florescence phenomena as a possible means of identifying radioactive materials inside sealed cargo containers.

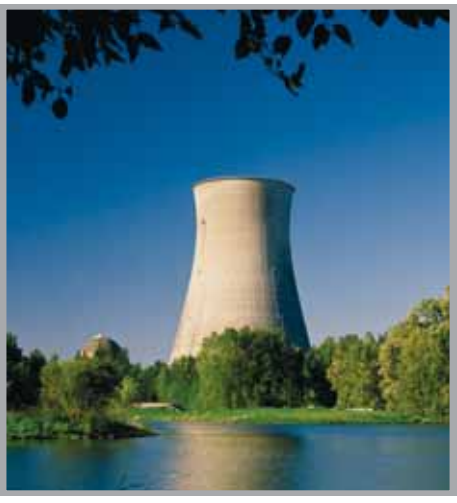
Other Activities

A panel devoted to Nuclear Energy and Safety was conducted during the STCU-NATO "From Science to Business" Workshop held 10-11 October in Kyiv. At the panel, seven presentations by Ukrainian scientists were made and a variety of issues discussed related to science, technology, and commercialization in the nuclear field.

NEW ELECTROCHEMICAL TECHNOLOGIES FOR RADIOLOGICAL DECONTAMINATION

STCU Project # 4129, "Development of Technology and Prototypes of Equipment for Electrochemical Radiological Decontamination of Industrial Equipment" was one of the selected projects from the 2006 Targeted Initiatives cycle between STCU and the National Academy of Sciences of Ukraine. This US$ 50,000 project was jointly financed by Canada, the EU, Ukraine, and the U.S. Scientists from Ukraine's Verdansky Institute of General and Inorganic Chemistry and Institute of Nuclear Research will develop electrochemical technologies to perform surface decontamination of industrial equipment, both in cases of accidentally radiological contamination or contamination due to normal nuclear power station operations.

These decontamination technologies will provide safe and economical restoration of expensive nuclear-related equipment, so that this equipment can be re-used safely and can avoid the need for special disposal and accumulation of dangerous materials. The project also will address the current problem of contaminated equipment in the shop area of the Chornobyl nuclear power plant.



HIGHLIGHTED TECHNOLOGY

NEUTRON FILTERED BEAM TECHNIQUE AT THE KYIV RESEARCH REACTOR (KRR)

Description

The neutron filter technique is characterized by the transmission of neutron beams emanating from nuclear research reactors through relatively thick (up to 2-2.5m) layers of materials with deep interference minimums in the total neutron cross sections. As a result of passing through these interference minimums, narrow energy range "filtered" neutrons emerge as quasi-monochromatic beams. Figure 1 below provides a cross-sectional view of the pro-posed neutron filer as located in the reactor's hori-zontal experimental channel.

Quasi-monochromatic neutron beams emerge from the filters with the following energies and half-widths: En(keV) = 1.86 (1.46), 3.57 (1.68), 7.5 (0.1), 12.67 (1.2), 24.34 (1.8), 56.37 (0.55); 58.8 (2.7), 133.3 (2.8), 148.3 (14.8)

Innovative Aspect and Main Advantages

The KRR has specialized in neutron filters for more than 20 years, with a very significant amount of knowledge and experience accumulated—characterized by the following:

• The filtered neutron beams emerging are of among the highest flux values in the world for the kiloelectron volt energy range: 105–108 neu-trons/sec•cm2. This provides an opportunity to conduct unique and very precise measurements.

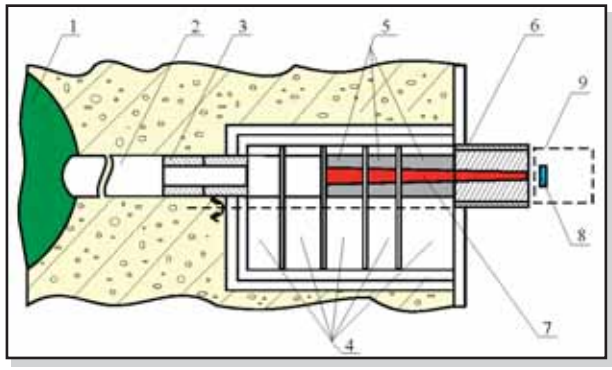
• Large quantities of highly enriched (stable) iso-tope (such as 52Cr, 54,56,57Fe, 58,60Ni, etc) are available at the KRR facilities for designing and constructing specific energy-range filters which provide very high neutron fluxes within narrow (i.e., "clean") energy bands.

Areas of Applications

1. High precision measurements (0.1 – 0.01 %) of total and partial cross sections for fundamental neutron-nuclear investigations
2. Precise measurements (to 1%) of neutron cross sections to obtain averaged nuclear parameters
3. Measurements of neutron capture gamma-spectra and activation cross sections
4. Isomeric ratio investigations and Doppler-Effect Investigations
5. Time-of-flight method used for precise cross section measurements
6. Research of radiation damage energy dependence in materials
7. Neutron radiography and tomography
8. Neutron and Boron-neutron capture therapy, Bio-medical investigations
9. Prompt Gamma-ray Activation Analysis (PGAA)
10. Development of standard fluxes for neutron-dosimetry

Stage of Development

Naturally occurring and enriched isotopes used in the development of neutron filters include:



Schematic of neutron filtered beam facility
(1 beryllium reflector; 2 horizontal channel tube; 3 preliminary collimator; 4 beam shutter disks; 5 filter-collimator assembly; 6 outer collimator; 7 filter components; 8 research samples; 9 device for samples removing.)

Natural: Si, Al, V, Sc, S, Mn, Fe, B, Ti, Mg, Co, Ce, Rh, Cd, LiF.

Enriched: 52Cr (99.3), 54Fe (99.92), 56Fe (99.5), 57Fe (99.1), 58Ni (99.3), 60Ni (92.8-99.8), 62Ni (98.04), 80Se (99.2), 10B (85), 7Li (90).

Three horizontal channels at the KRR are currently equipped with such neutron filters and with experimental installations for the precise measure-ment of total, scattering and capture cross sections. There is also the possibility to study capture gamma ray spectra with a Ge spectrometer characterized by its high resolution and angle distribution of scattered neutrons. Each of the filters is easily replaced by another to meet beam characteristic requirements, and the development of new filters is currently in pro-gress for producing neutron energies up to 1000 keV.

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PHYSICS

Within the year 2006 five project proposals marked with Physics as primary S&T area were registered at STCU.

Project Activity

In 2006, two regular projects addressing to physics S&T were funded. STCU Project #3752 entitled "Creation of the model of water balance and water quality in Basin of Syrdarya River. NAVRUZ-3" formally marked as related to physics S&T was funded by the U.S. in the amount of US$309,752. This is the third stage of a long-term cooperative STCU/ISTC research initiative aimed at characterizing with radionuclides and toxic metal contamination of the water basin of Central Asia region. This cooperative initiative unites research teams from Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan. Uzbekistan represented by the team from Institute of Nuclear Research, is involved through STCU project #3752 while other technical units participate through ISTC projects.

STCU Project #4114 "A laser based on semiconductor quantum billiard: modeling on millimeter waves", proposed by technical unit from O.Ya. Usikov Institute of Radiophysics and Electronics and gained EU funding in the amount of EURO 52,210. This project will demonstrate the practicability of semiconductor laser employing the "quantum billiard" effect – the ballistic charge carriers' motion in microscopic area of GaAs semiconductor confined by potential barrier.

During 2006, the Max Plank Institute of Plasmaphysics (Germany) committed EURO 30,000 to fund the consecutive phase of Partner Project #P-034. Within this project scientists from the Institute of Nuclear Research (Kyiv) investigate physical processes in plasma with reference to stellarator and tokamak facilities. As of today, this collaborative project totals to US$198,000 and EURO 62,000.

Other Activities

2006 STCU officials attended to the regular meetings of European Contact Expert Groups working in support of the decision making process of EU Financing Party for ISTC & STCU projects related to Nuclear Power Plant lifetime management (CEG PLIM) and to Fusion R&D (CEG-FUSION).

On June 8-9 STCU representatives participated in 4th EU CEG-PLIM meeting in St. Petersburg with presentation of review of STCU projects concerning the Nuclear Power Plants Lifetime Management Issues. According to the recommendation of CEG two PLIM projects prepared by Ukrainian experts were presented at the 5th EU CEG-PLIM meeting in Bergen, Netherlands.

The 2nd EU CEG-FUSION meeting held in Brussels on 20-21 September, 2006 brings together European experts on Fusion, contact persons from ISTC and STCU and representatives of Fusion community from ISTC and STCU recipient countries (see Success Story).

CONTRIBUTION OF UKRAINIAN SCIENCE TO THE EUROPEAN FUSION PROGRAM

SUCCESS STORY

The STCU delegation composed of a STCU senior specialist and three scientists with expertise in plasmaphysics and magnetic field diagnostics participated in the 2nd Meeting of the European Contact Expert Group for ISTC/STCU Projects on Fusion RTD (CEG-FUSION) held in Brussels on 20-21 September. This meeting was dedicated to the assess the capabilities of fusion communities in CIS countries, the identification of potential new projects and the promotion of proposals that would contribute to the aims of fusion RTD, and to the facilitation of cross fertilization of allied STCU/ISTC projects. A Survey of the STCU Fusion-related projects was presented as was a report on Ukrainian fusion programs and two proposals with high potential to contribute European Fusion programs: The STCU proposal #4155 "Experimental study of high-power plasma interaction with materials under conditions relevant to tokamak-reactor." Project #3988 "Radiation hard Hall Probes and devices for JET".

HIGHLIGHTED TECHNOLOGY

HIGH PRODUCTIVE FILTERED DIRECT CURRENT CATHODIC VACUUM-ARC PLASMA SOURCE

Description

This is a Cathodic vacuum arc plasma source with a magnetic filter, which turns the plasma stream 90°, A T-shaped plasma duct with a system of intercepting screens and fins provides a significally higher degree of absorption of macroparticles when compared to conventional "toroidal" filters (more than an order of magnitude). A small ratio of curvature radius of the plasma duct to its inner radius, a large diameter of the plasma guiding channel (200 mm), and an optimal geometry of transporting magnetic fields ensure a high throughput of the filter - up to 55 %. The filtered plasma source proposed may be used in new vacuum-arc industrial setups for the ion plasma processing of materials including deposition of high quality coatings.

Innovative aspect and Main advantages:

Efficiency of the main versions of known systems and our results

The ratio of the total ion flow at the channel exit to the discharge current (Ii/Id) -

Type of filters	Knee shaped [Falabela]	Toroidal (45°) [Martin]	Rectangular [Gorokhovsky]	Dome type [Sanders]	Wide aperture (our results)
Efficiency $I_i/Idx100$, %	3,0	2,5	2,5	2,5	about 5

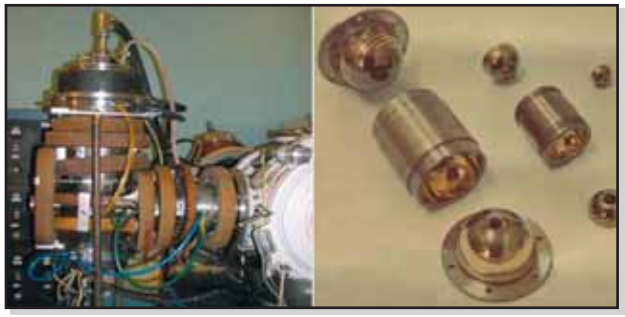
the system efficiency coefficient - is commonly assumed to be the criterion of plasma passage efficiency through the system as a whole (generator + filter).

Areas of Application:

Filtered vacuum-arc plasma source described can be used for the following coating deposition: DLC, metals (Ti, Cr, Nb, Mo, Cu, Al, etc.), alloys, nitrides, oxides, carbides, composites, multilayers.

Such coatings can be used as:

- wear-resistant coatings at surfaces of fine mechanic elements (hydrodynamic and electrostatic supports of gyroscopes and centrifuges, pistons of fuel pumps, etc.);
- decorative coatings;
- hard protective coatings on magnetic and optic devices;



T-shaped filtered vacuum-arc plasma source for diamond-like coating (DLC) deposition.

Elements of the gas dynamic bearing with DLC coatings (convex hemispheres) and with TiN coatings (concave hemispheres).

- transparent conducting oxide films in solar sells;
- low-e films on architectonic glass;
- protective biologically indifferent coatings;
- "back-end" metal layers in ultra large scale integrated circuits;

Above mentioned filtered plasma source may be used:

- in new vacuum-arc industrial equipment for the ion plasma processing of materials including deposition of high quality micro- and nanostructural coatings;
- when upgrading of existent vacuum-arc equipment for widening their technological potentiality;
- for high quality coatings deposition processes in machine building, fine mechanics, microelectronics, optics, automobile industries, etc.

Stage of Development:

Prototype available for testing; patented in USA.

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