



## NEWSLETTER

### Special Edition-Coverage of International Nano Olympiad Forum Issue: 31



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## **1. Introduction**

Nanoscience and nanotechnology knowledge promotion program for young generation studying at universities are expected to have great impact on the future development of human resources for all of the countries who have national plans on these important areas. In this respect, provision of necessary educations along with scientific competitions can have a great impact on such important issue. The aim of the forum was to exchange ideas about the possible organization of an International Nano Olympiad (INO) for undergraduate students. The initiative was discussed from different perspectives including antecedents, implementation aspects, and consequences. I.R. IRAN has held national nanotechnology Olympiads since 2011. In 2015 more than 6300 university students (undergraduate) participated in Iran national nanotechnology competition. Many participants of these events have been motivated to continue study and work in the field of nanotechnology. Similar schemes also have been implemented in some other countries which were introduced in the event. During the event, authorities from national nanotechnology development institutes, organizations and other related nanotechnology education administrations from ANF economy members and other interested countries were gathered to discuss about relevant issues in this important event.



**Islamic Republic of Iran  
Presidency**

**Iran Nanotechnology Initiative Council**

Iran has recognized the significance of nanotechnology like other pioneering countries and started its activities in harmony with her 5<sup>th</sup> national economic development plan. In this regard, as the first step, a nanotechnology study committee started its activities in 2001 leading to establishment of Iran Nanotechnology Initiative Council (INIC) in 2003. Further, INIC developed the first 10 year national nanotechnology initiative plan which was approved by the government in 2005. The INIC is tasked with determining the general policies for the development of nanotechnology in the country and pursuing the case with implementation of the policies. Iran's success in achieving a proper place among 15 top countries in nanotechnology and making attempt to promote the position in a bid to develop Iran's economy are the main missions of the INIC.



INIC is seeking to pave the road for activity of the private sector and production of wealth within the society through providing facilities, creating market and removing the impeding obstacles.

Asia Nano Forum (ANF) is a network organization, founded in May 2004 and now a registered society in Singapore, known as Asia Nano Forum Society, since Oct 2007. The mission of ANF is to promote responsible development of nanotechnology that educationally, socially, environmentally and economically benefits each economy by fostering international network collaboration.

## **2. Gallery**



### 3. Background

Given the fact that nanotechnology knowledge promotion programs for young generation is an important issue to foster the future development of this emerging technology, Iran Nano Initiative Council (INIC) from its early days of its establishment have put great emphasis on this matter by running 7 nano Olympiad since 2009. Further, INIC proposed to host an international event co-organized with ANF in EXCo interim meeting in Tokyo Jan. 2016 with the aim that all



interested countries from Asia and elsewhere could share their experiences and come up with a plan for the establishment of an international organization to run such program worldwide.

On the other hand, the idea of having a forum on Nanoproduct certification and labeling, as another important issue was also emerged from discussions initiated by Iran delegation in ANF summit in Singapore in August 2015. Given the efforts and experiences of all member states in this area, the need for a dedicated and focused event was also recognized.

These two Forums hosted by INIC and co-organized by ANF was decided to be held in May (17th to 19th) 2016 in Tehran, Iran. Delegates from Thailand, Taiwan, South Korea, Malaysia, Singapore, Russia and Kazakhstan accepted the invitation to join in both events.

It is hoped that these events, through sharing knowledge and bringing closer the different ideas and perspectives, lead to further collaboration between all participating countries in such important aspects of nanotechnology development.

### **The First International Nano Olympiad (INO) Forum**

The First International forum on INO was held in Tehran, Iran, 17 May 2016. The following representatives were present in this event: ANF representative, Iran, Kazakhstan, Malaysia, Russia, South Korea, Taiwan, and Thailand.

Before the aforesaid forum, an initial draft of the INO proposed regulation presented to the participants to be considered for possible revisions from the mentioned representatives, as INO's possible steering committee members.

The followings were the suggested clauses of the INO regulation draft:

Clause 1: Competition General Statement, Important Dates, and Participation

Clause 2: INO Executive Committee

Clause 3: INO Scientific Committee

Clause 4: INO Steering Committee

Clause 5: INO Information Center

Clause 6: Procedure of the INO Competition

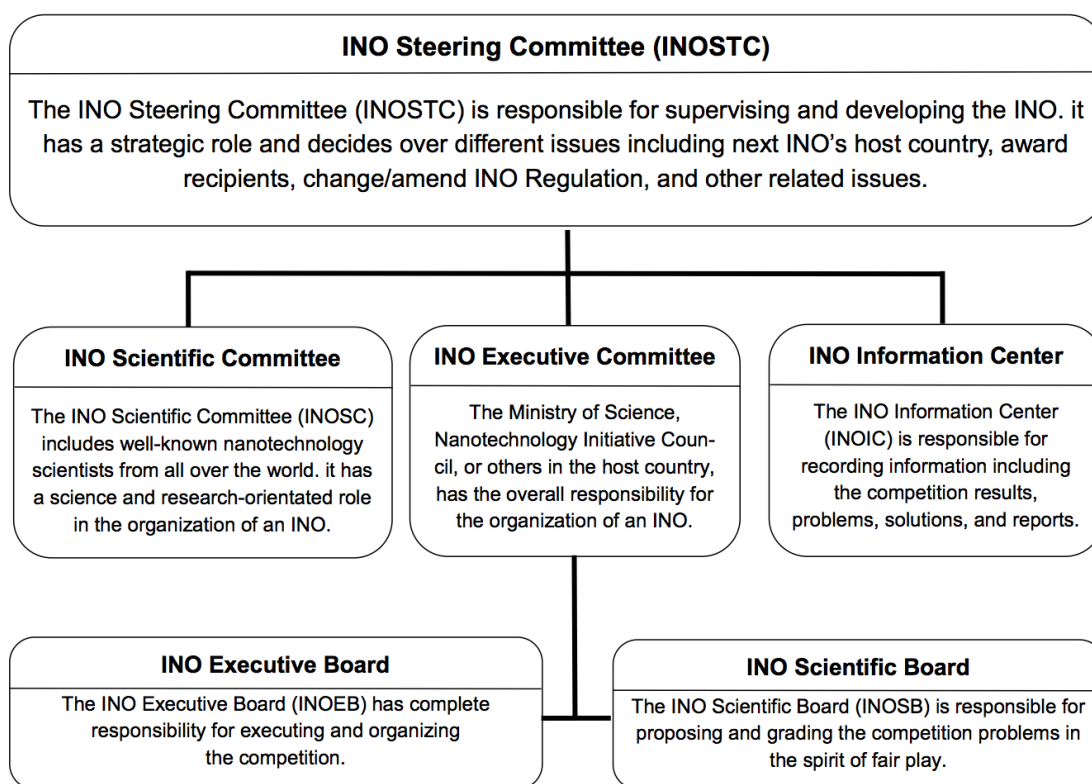
Clause 7: Problems of Competition

Clause 8: Result and Prize Announcement

Clause 9: Validity of the Regulation

Below is the initial proposed organization chart by IRAN for the first INO:

INIC Initial Proposal for the First INO Organizational Chart



It was proposed that the INO to be held biennially for undergraduate students. Also after initial discussions, the need for INO steering committee was emphasized. Interested members from ANF will continue to discuss the details of the INO in the next 6 months.

#### 4. Program

Line	Topics	Chair/Co-chair	Agenda
1	Registration Holy Quran Citation	-	-
2	-Welcoming Address Prof. Ali Beitollahi ( Director of international collaboration and nanostandardization Committees, INIC) -Roll Call of the countries' representatives -Nomination of Drafting Committee for minutes of the meeting	-	-
3	- INIC: Policy, Program and Activities on Nano-Education Prof. Saeed Sarkar (INIC Secretary General)	-	-
4	Country Report: <ul style="list-style-type: none"> <li>- Korea</li> <li>- Taiwan</li> <li>- Malaysia</li> <li>- Russia</li> <li>- Thailand</li> <li>- Iran</li> </ul> (15 minutes for each country) Including Q&A	<ul style="list-style-type: none"> <li>- Dr. Eung-Sug Lee (Korea)</li> <li>- Dr. Lerwen Liu(ANF)</li> </ul>	<ul style="list-style-type: none"> <li>- Program</li> <li>- Activities</li> <li>- Achievements</li> <li>- Formerly Held Nano Competition process/ procedures</li> </ul>
5	Coffee Break	-	-
6	<ul style="list-style-type: none"> <li>- Overview of International Nano Olympiad(INO) Initiative and short/long term strategies By Dr. Lerwen Liu (ANF, Nano Globe)</li> </ul>	<ul style="list-style-type: none"> <li>- Prof. Maw-Kuen Wu (Taiwan)</li> </ul>	<ul style="list-style-type: none"> <li>- Impacts , Expected Aims</li> <li>- Structure</li> <li>- Infrastructure</li> <li>- Stakeholders</li> </ul>
7	Discussion on Draft Proposal for the 1st International Nano Olympiad. By Prof. Ali Beitollahi (Iran)	<ul style="list-style-type: none"> <li>- Prof. Maw-Kuen Wu (Taiwan)</li> </ul>	<ul style="list-style-type: none"> <li>- Overview of the initial proposed draft and review of comments</li> <li>- Implementation Aspects</li> <li>- Regulations and Requirements</li> <li>- Procedures and Subjects of Examination</li> </ul>
8		13:00-14:00	Lunch
9	Discussion on the 1st International Nano	- Prof.	- Date



## ANF Newsletter: Special Edition-Coverage of International Nano Olympiad Forum

	Olympiad Plan and Steering Committee Establishment	Maw-Kuen Wu (Taiwan) - Prof. Ali Beitollahi (Iran)	- Venue - Host - Registration - Procedures - Nomination - Terms of reference
10	<ul style="list-style-type: none"> <li>Country report on Nano-E-learning and educational packages, (10 minutes for each country )</li> <li>INO E-learning Platform Discussion</li> </ul>	- Dr. Anastasia Grigoreva (Russia)	- E-Learning - Training trainers - Training infrastructures
11	Coffee Break		
12	-Review of minutes of the meeting -Remarks and any other Business	- Dr. Lerwen Liu(ANF)	

## **5. International Nano Olympiad (INO) Forum Recommendations**

At the end of the sessions, some recommendations were agreed by the representatives about competition which is reported as below:

The INO needs to address innovation and sustainability.

The meeting agreed the need to form steering committee before the end of June 2016.

The steering committee needs to meet during ANF summit 2016 (July 13-14) to ratify the statutes and manifest of the INO.

The issue of raising fund and finding the right partners and sponsors was raised.

Iran agreed to host the first INO in late November 2017.

## **6. Summary of Presentations on Nano Education**

### **Overall Summary of INO workshop**

**Summarized by Dr. Lerwen LIU (ANF Founding Secretary)**

The Goal of ANF International Nano Olympiad (INO) is the following:

1. Empowerment of Youth through Promoting Sustainable Development of Nanotechnology
  - a. Acquiring Knowledge of Nanotechnology
  - b. Sharing Global Experience in Education
  - c. Addressing Relevance of Nanotech to Sustainability
2. Internationalization of Nanotech Development
3. Making Nanotech Relevant
4. Simulate Interest in Nano Science and Engineering (NSE)

The International Nano Olympiad (INO) initially focuses on undergraduate students with the following scope:

1. Scientific and Technological Innovation (NSE)
2. Design Innovation
3. Business Model Innovation
4. Grand Challenges

## 5. Societal Implication

The proposed INO operational structure is the follow:

1. Advisory Committee (S&T and Industry- Seniors)
2. Organizing Committee (Local & Youth)
3. Judge Panel Members (Local & Experienced)
4. Secretariat (starting with ANF Secretariat until the next volunteer organization takes over among ANF members)

INO Revenue Model:

1. Public Funding - Ministry of Education (MOE), University
2. Sponsorship – Industry (e.g. Google, Intel etc), NGO (e.g. Gates Foundation)
3. Private Funding – Asia Development Bank (ADB), World Bank (WB), Islamic Development Bank (IDB) or other financial institutions

Proposed Activities (Immediate):

1. *Inaugural event -2017- INIC (Iran) to host*
2. *2018 and Beyond*
3. *Website & Newsletters*
4. *Marketing -Outreach to universities worldwide*

Immediate Action Plan for 2016

1. *Inaugural Organizing Committee*
  - a. ANF secretariat (Lerwen Liu), Iran (Ali Beitollahi, Kazakhstan (), Korea (),Malaysia (), Russia (), Taiwan (), Thailand (), etc
  - b. Focused Scope
    - i. S&T, Grand Challenges
    - ii. Output & Impact & Customers
  - c. Local organizing committee?
  - d. Time lines
    - i. Jul 13-14<sup>th</sup> – Set up Steering Committee
    - ii. Jun 8<sup>th</sup> - Lerwen to write up 1 page summary
  - e. *Newsletter for INO Forum May 2016- end of June*
  - f. *Outreach- Identify Sponsors?*

**ANF Representative**

## **Nanoscale Science and Engineering Education- an Asia Perspective**

**Presented by Dr. Lerwen LIU (ANF Founding Secretary)**

The National Nanotechnology Initiative (NNI) launched in 2000 by the USA government inspired global nanotechnology initiatives with massive funding from government and industry worldwide. Nano Science and Engineering Education (NSEE) has become increasingly important with accelerated adoption of nanotechnology in today's manufacturing towards sustainability. Nanotechnology has been adopted almost in every industry and products used in our everyday life ranging from consumer electronics, aerospace, automotive, energy, water and medicine. It is critical that nanotechnology is being placed strategically in today's education programs not only to simulate innovation towards sustainability but also for training the massive workforce needed in today and tomorrow's product design and manufacturing. Nanotechnology promises less consumption of materials with higher and safer performance as well as reduction/elimination of toxic processes involved in manufacturing.

NSEE is interdisciplinary in nature. It is where physical sciences intersect with life science; and science merges with engineering and social science. It enables scientific and technological innovations. The emerging bio-inspired nanotechnology is one example of the exciting developments where biology emerges with physics, chemistry, and materials engineering enabling novel product design and manufacturing.

Governments in Asia (being the world's biggest manufacturing hub and consumer base) spend more than Europe and USA in Nanotechnology R&D and are accelerating its efforts in training skilled scientists and engineers to meet the demand of innovation and advanced manufacturing. In this talk we summarize the Asian's effort in NSEE initiatives, programs and interesting practices. In particular, we highlight some of the outstanding efforts from Taiwan, Korea, Japan, Iran, China, Thailand and Singapore. Taiwan includes nanotechnology education in its national nanotechnology initiative and allocates about 2.5% of its total nanotech funding (about 2-3 million USD/year dedicated to NSEE) in developing education infrastructure, curriculum and public outreach. Korea started the process of developing standardized nano education curriculum and textbook. It also created the e-learning platform called e-NanoSchool system which also provides online lecture services. Japan stands out for its effort in developing multidisciplinary

and Academia-Industry nano education program at graduate school level offered at Osaka University. Tsukuba University in Japan, being part of the industry consortium Tsukuba Innovation Arena (TIA), goes further to include international collaboration in its PhD Honors Program with focus on nanoelectronics. Iran Nanotechnology Initiative Council places strong emphasis on nanotech education and has extensive undergraduate and postgraduate programs in universities across Iran. Its Nano Olympiad initiative grew 20 times during a 4 year period to over 20000 participants in 2013. The Thailand National Nanotech Center (NANOTEC) operates the Nanotechnology Learning Center (NanoPlus Learning Center) has reached to 250,000 trainees since 2008 with 190 trainers trained. Soochow University in China offers a unique Bachelor Degree in NanoMaterials and Technology in collaboration with University of Waterloo with joint curriculum in English. This collaboration extends to MSc and PhD through exchange research program between the two universities. The National University of Singapore pioneered nanotech education program in Singapore offering NSE modules at faculty of science and faculty of engineering. In recent years, NUS offers general education modules (GEM) in nanotechnology to all undergraduate students. In 2014 NUS launched a GEM in nanotechnology that provides a holistic approach in NSEE making NSEE relevant to solving real world problems. This module aims to make nanotechnology relevant to students through elaborating how it enables technological innovations in making a smartphone today and tomorrow. Students are required not only to understand the scientific principles, but also product manufacturing value chain and processes. Students are required to learn about the economics of nanotechnology through cost analysis, business model innovation and marketing.

In addition, students are made aware of environmental impact of materials used and manufacturing processes. They need to learn not only technological innovation, but also product design and business model innovation. The module enhances students' understanding and experience with nanotech through forming a virtual company and presenting a business plan of responsible solution for a real life problem. The business plan is prepared to include identifying a problem; market research on existing solutions; an innovative solution; solution implementation business model and marketing; and addressing sustainability of solution. Students are required to present their business plan to external panel of experts from government funding agencies, research institutions, NGO, private investors and industries.

## **Iran**

### **A summary of Iran Nanotechnology Education Policies and Activities**

#### **Presented by Prof Ali Beitollahi (INIC)**

Iran nanoscience and nanotechnology education policy has aimed at improving human resources in terms of quality and quantity. Identifying, motivating and guiding talented students are some of the goals that Iran pursues to direct scientific and research activities. As the target community, the policy considers high school students, undergraduate students and graduated students. For each group, there are various programs such as competitions, educational portal, seminars and courses.

For high school students, National Nano Olympiad (NNO) is the mean to motivate them and enhance their scientific knowledge. “TAVANA”, the Educational Nano Lab program, provides the equipment needed for high school talents to begin their nano related research in practice. Furthermore, “NANO BELL” Magazine, educational Seminars & Workshops are some of the other activities at high school level. Finally, training the trainers program is an important part of Iran education policy for high school students.

For Undergraduate students, National Nano Competition is one of the major programs to help them to enhance their capabilities and knowledge. As another initiative, the Nanotechnology Education Portal is the largest Nanoscience/technology reference in Iran. Promotion Societies Network, university seminars & workshops also play an important role in supporting the Nanotechnology achievement at the university level. Also, the Capacity Building Program aims to enhance social and individual abilities of students as team members in their future carrier life. Finally, Nano Weeks holding in each state of Iran, promote nanotechnology in universities across the country.

Graduate students have the chance to pursue their novel ideas from theoretical concept to industrial scale via the Nano Match program. This program helps them by provision of financial supports and assist them meet their trusted investors. Also, support packages for MSc. & PhD thesis and publications will help graduate students to pursue academic goals.

Below chart shows the Milestone of Nanotechnology educational plan in Iran.





## Korea

### Summary on the Education Programs for Nano Convergence Technology Expertise in Korea

#### Presented by Dr. Eung-Sug LEE (KoNTRS)

Dr. Eung-Sug Lee has made a significant contribution for the development of nanotechnology in both research and policy fields. He has made remarkable research in nanoimprint lithography technology through University-Institute-Industry collaboration. Moreover he played a leading role in establishing networks of nano researchers and vitalizing nano communities.

Over the period of 14 years, Korea government has invested total of Total 3,983 Billion KRW( $\approx$  3.4B USD) in nanotechnology research. In this process, Korea has gone through the 2 level of phase. In first phase, we aim to enter the world top 3 countries in nanotechnology competitiveness from 2006 to 2010. And then we have been focused on world top level of R&D activities, related products, and industries on nanotechnology from 2011 to 2015. Now we

moved on to a new phase which is 4th phase (2016~2025) for Initiatives of nanotechnology and aim to world-class leading country based on sustainable growth through the technical innovation. On the 4th phase, we are going to target the 92% level of nanotechnology (Compared with USA of 100%) and cultivate 12,000 of Key human resources. And we have also targeted projects Increase market share of nanotechnology based products which is up to 12%, compared with new industries.

So, Korea is not the only country which is aware of the importance of nanotechnology in the world. However, as a country which successfully demonstrated rapid progress in almost every industrial field, we are fully aware of the importance of nanotechnology and have established a nation-wide organization, the Korea Nano Technology Research Society (KoNTRS). Since 2003, our Society has played a pivotal role in establishing world-level nanotechnology programs within the country with ever increasing members.

In 2003, Korea's nanotechnology researchers totaled around 4,000 at most, and most of them joined this field of nanotechnology from various disciplines. By 2015, however, the number of researchers had increased more than two-fold the original number to approximately 9,000. Moreover, a well-coordinated educational program was established in the University, and college-level nanotechnology-related departments increased to about three-fold to 91 at present.

As an Institution comprised of over 2,000 nanotechnology researchers to promote the exchange of information and human resources and to generate cooperative research programs among the researchers, Korea Nano Technology Research Society is a unique legal entity authorized by the Minister of Science, ICT and Future Planning (MSIP) according to Clause 7 of Nano Technology Development Promotion Act.

In order to accomplish its purpose of establishment, Korea Nano Technology Research Society is carrying out "Korea Nanotechnology Initiatives" and "Nanotechnology Road-Map" to support government policies, and launching an international conference named as "NANO KOREA Symposium" and an international journal entitled as "Nano Convergence". Our Society has also contributed much to the education of nanotechnology within Korea by publishing textbooks related to nanotechnology, and by establishing the programs such as "e-Nanoschool" and some

experimental hand-on courses in collaboration with the National Nano Fab Facilities within Korea.

## **Malaysia**

### **Industrial Driven Initiatives to Promote Nanotechnology as Part of Science, Technology, Engineering and Mathematics (STEM) Education in Malaysia**

**Presented by Kamarulzaman Kamaruddin (NND) and Nur Aainaa Syafini Binti Mohd RADZI (NanoMalaysia)**

Nanotechnology has been identified as one of the emerging technologies that will tremendously benefit the Malaysian economy by value adding the various key industrial sectors through the development of high value products and activation of higher value chain of manufacturing activities. In ensuring a sustainable development of new products and economic growth based on nanotechnology, continuous availability of talents needs to be available to support the industry where the cultivation of these talents needs to start from school level, all the way through universities.

Driving nanotechnology product development based on industrial and market needs through the iNanovation platform, NanoMalaysia in partnership with industries aims to increase the number of local experts in nanotechnology through technical up-skilling on existing relevant workforce, creating more talent pipeline from universities and cultivating interest of school students to match the developmental pace in this field. The developed talent pool is key to support the four economic jumpstart sectors in Malaysia, namely Food and Agriculture, Energy and Environment, Wellness and Healthcare, and Electronic Systems.



NanoMalaysia – IBM joint research and development program, a key initiative monitored by Malaysia Global Science and Innovation Advisory Council (GSIAC) to enhance human capital development.

As part of a key initiative monitored by Malaysia Global Science and Innovation Advisory Council (GSIAC) to enhance human capital development, NanoMalaysia and IBM Research have embarked on a joint research development programme to develop polymer based nanomaterials that will ease access to antimicrobial coatings; and drug delivery applications addressing non-communicable diseases (NCD) in Malaysia such as: cancer, cardiovascular diseases, diabetes and obesity in the healthcare and medical industry.

This joint research programme based at the IBM Research Centre, Almaden, USA and fully sponsored by the Ministry of Higher Education (MOHE) Malaysia, ultimately aims to accelerate the development of science and technology to create innovative, marketable products and services that have global applications. As present, 23 researchers from 10 Universities has been trained at IBM where these Malaysian researchers has contributed to joint patents filing and publication of high impact technical papers.

Other industrial lead nanotechnology programmes driven by NanoMalaysia with key Malaysian research institutes and universities are in the development of nanocomposite thermal conductivity substrates with Universiti Teknologi Petronas (UTP) for LED and electronic applications, and the production of nanocellulose and nanofibers with the Forest Research Institute of Malaysia (FRIM) and Universiti Malaysia Pahang (UMP) will create a talent pool to spur future industrial application developments in this areas enabling commercialisation of high value-added products supporting the growth of Malaysian economy.



Further supporting these initiatives, NanoMalaysia has an internship programme where university students undertaking STEM based degree programmes are encouraged to specialize in nanotechnology areas in their undergraduate and postgraduate studies.

In April 2016, NanoMalaysia conducted a “Nano Technology Awareness Briefing” to secondary schools students from the state of Sabah. During this event, with the support of a local nanotechnology company (Nano Textile Sdn. Bhd.), some



1,150 students were given Nano socks (nano-tech socks) with anti- stench, bacteria, and moss prevention properties through the infusion of nanomaterials into the socks material. The introduction of nanosocks to students will enable them to learn and appreciate how nanotechnology can be applied to textile and other daily apparels encouraging them to cultivate an interest in science and technology, particularly the field of nanotechnology and also to instill awareness on wellness and cleanliness among the students.

Nano based socks with antimicrobial properties given to students (witnessed by the MOSTI Minister) to cultivate the interest of STEM education in Malaysia.

## **Russia**

### **"NANO" EDUCATION AND "NANO" COMPETITION PROJECTS OF THE RUSNANO GROUP (RUSSIAN FEDERATION).**

**Presented by Mr. Andrey MELNIKOV (RUSNANO) and Dr. Anastasia GRIGOREVA (Moscow State University)**

RUSNANO Corporation implements state policy for the development of the nanoindustry in Russia, acting as a co-investor in nanotechnology projects, which have substantial economic or social potential.

RUSNANO Group includes Open JSC RUSNANO, RUSNANO Management Company LLC and the Fund for Infrastructure and Educational Programs.

JSC RUSNANO supports state policy for the development of the nanoindustry by investing in high-tech projects and creating new industries inside Russia. On 27 January 2016 the sole shareholder of the Open Joint Stock Company RUSNANO approved the amended and restated charter of the company according to which the company was renamed to Joint Stock Company RUSNANO.

Management of the assets of JSC RUSNANO is the responsibility of RUSNANO Management Company LLC.



The company invests in a wide array of projects: alternative energy, biomedicine, new materials, mechanical engineering, and metalwork to name a few. For entrepreneurs with the right ideas and the skills and vision to carry them through, funding is available to manufacture new products or to broaden and modernize existing production.

The objective of the Fund for Infrastructure and Educational Programs (FIEP RUSNANO) is to create infrastructure for technical innovation in Russia.

The FIEP RUSNANO was founded during the reorganization of the Russian Corporation of Nanotechnologies. It stimulates nanotechnology infrastructure building to support innovation in the country. The Fund for Infrastructure and Educational Programs primarily focuses its activity in these areas:

- Formation of infrastructure for nanotechnology
- Development of human resources for the nanoindustry
- Market development for nanotechnology products
- Improvement of the legislative framework for innovation
- Standardization and certification of nanoproducts and evaluation of their safety
- Refinements in metrology
- Popularization of nanotechnology and nano-enabled products.

The highest governing body of the fund is its Supervisory Council, which is chaired by Deputy Minister of Education and Science of the Russian Federation Alexey Ponomarev. In accordance with the charter of the fund, the council determines priorities for its activities, establishes its strategies, and sets its budget. The Management Committee is the fund's collegial executive body. It is chaired by RUSNANO CEO Anatoly Chubais. Andrey Svinarenko is CEO of the Fund for Infrastructure and Educational Programs.

Initially Russian nanoindustry faced several challenges in a highly professional staff development as follows:



Lack of specialists in Engineering with appropriate, sufficient competencies and capacity in High-tech, incl., application of nanotechnology.

Almost general lack of professional development programs in nanoscience/nanotechnologies aimed to train/re-train personnel for emerging high-tech/nanotech industry,

For a long period there were no signals or clear demands from local labour market for stuff competencies (content, level, qualities) required by enterprises in nanoindustry.

Nowadays more than 50 higher educational institutions (HEI) in Russia have degree, post-degree, doctoral, post-doc and professional development programs in nanoscience (nanotechnologies, nanosystems) and related areas.

The educational projects and programs of the Fund are focused on the development of human resources for the nanoindustry.

More than 150 PD, re-training and degree custom-made programs were designed by HEI and scientific organizations on request of FIEP RUSNANO to train the personnel (4 400 engineers and managers) of 122 companies in nanoindustry. As a result of more than 200 companies and about 40 universities collaboration 45 professional standards for engineering personnel in nanoindustry have been elaborated during the last 4 years.

Special eLearning and blended Programs for PD & re-training of engineering personnel, school students in STEM area and basics of nanoscience. Since 2012 more than 400 modules, virtual laboratories and simulators were created. Special inter-universities Master degree program for engineers as “tech-entrepreneurs” in high-tech sphere was established.

The development of further training programs for engineers and senior executives of nanotechnology companies, in line with the development of new technologies, is one of the major areas where the Fund interacts with the labour market. The scope of the programs is defined by the companies in accordance with their actual human resources needs. The educational programs have modular structure, and they consist of distance training programs, virtual simulators and training systems that ensure the minimum interruption of the work activities of trainees.

The Fund develops the professional standards for advanced engineering professions in nanoindustry—the regulations that can be used by nanotechnology companies as qualifying standards for professional training of experts. Those professional standards are also used as the basis for independent qualification assessment of engineers and technical personnel of the companies and graduates. The Fund develops the tests and learning activities for “professional exams”. Also the Program «Development of the professional qualification assessment system in nanoindustry» (3 assessment centers to be organized in 2018) was launched. Accreditation of educational programs in nanoscience and nanotechnologies sphere by professional community has been developing since 2012 (already 35 programs have been accredited).

The Fund as well arranges for the events designed to improve the image of scientific, engineering, technology and business activities among children and young people. Those events include RUSNANO School League designed to promote quality reforming of the natural science education in Russian schools. Since 2010 the network of more than 600 schools from all over the country and abroad has been methodologically supported.

The Fund holds on regular basis the scientific and practical conferences; competitions; Nanograd vacation summer school; International Olympiad on Nanotechnologies “Nanotechnologies – Breakthrough Into The Future!” for school students, undergraduates, postgraduates and young scientists as pertaining to nanosystems, nanomaterials and nanotechnology, provided by Moscow State University and organized for students with the aim of rising their interest in R&D in nanotechnologies and new materials; all-Russia national school Week for High Technology and Hi-Tech Business.

International Olympiad on Nanotechnologies is an interdisciplinary competition which is intended to stimulate the activities of students interested in chemistry by a way of the independent and creative solution of chemical, physical, mathematical and biological problems in materials science. The main objectives of the Olympiad are as the following:

To make science education more exciting and attractive for young people.

To expose students to real-life problems and challenges.

To motivate school students to build their career in R&D technologies, science and academy.

To support most talented students

The Olympiad is provides the opportunity for school student of different ages (even from primary school) to participate and consists of the several contests for them such as: Theoretical Problems, Young scientists R&D competition “Simply about complexity”, School Projects “Genious Thoughts”, Best popular lecture on nanoscience “Nanotutor”, Popular theoretical round “Young Erudite”.

### Taiwan

#### Presented by Prof. Maw-Kuen WU (Academia Sinica)

My presentation at the ANF Forum on Education held in Tehran mainly addressed the “Education White Paper of Taiwan – How to Cultivate Young Talents”. This White Paper was prepared under the auspices of the Minister of Education of Taiwan as the guideline for the next phase of our general education plan for both the K-12 and college educations. There are two major objectives in the White Paper: (1) To cultivate young talents who can be competitive to face the challenges of the age of globalization, information and knowledge based economy; and (2) To raise the productivity of the young generation at least two time to meet the trend of ageing and less children society. In order to accomplish these two goals, the issue of “Change and Breakthrough” has been raised. We need to “Change” – to clearly identify where to “change” and what are the major differences after “change”; and the “Breakthrough” –Need “breakthrough” not only in perception, but also need to get out of the current constrained “box”. More importantly, we emphasize all levels’ administrators need to take up the responsibility to make the “change” a reality in order to achieve the objectives.

The key ideas we address are: 1. Talents need to cope with the world trends; 2. Talents cultivation need to match with the need of human resources; 3. Talents’ ability is more important than their academic records; 4. Talents cultivation need to fit to individual interest, personality and ability; 5. Talents cultivation has to be all-rounded and keep continuity; 6. Talents cultivation needs to follow the international standard; 7. Vocational Education needs to focus on the practical use of the knowledge learned; 8. Respect the academic freedom and market driven

mechanism of the University; 9. The distribution of education resources has to follow the principle of the society fairness; and 10. Encourage the industry to more involve in education and talents cultivation.

We further emphasize that the purpose of college education are: 1. To set high quality teaching and learning system as the foundation; 2. To establish the foundation for sustainable development of the society; 3. To cultivate talents to meet the societal needs; 4. To strengthen the talents' international competitiveness. And the directions of efforts include: 1. To promote university quality and students' competitiveness; 2. To adjust the total number of the universities and reset the recruiting policy; 3. To allow more flexible tuition and related matching policies; and 4. To create environment to recruit talents from abroad. In addition, I presented the action plans for our college education, which include: 1. To change university ruling policies and system deregulation that allow more self-regulate rules (freedom) in personnel and accounting system in public universities; allow outstanding private university to be self-regulated; create a normal mechanism for tuition adjustment; and change the awarding system to private universities after the new rules. 2. Enhance teaching quality, establish quality assurance mechanism to promote students' competitiveness. More urgently, we need to reset the total number of universities due to the decrease in house-hold birth rate and to redesign our immigration law to enhance our international recruiting policies.

I also gave a few example programs currently developed in the universities to improve our science and technology education. One of the most successful cases is the experimental physics course at the National Central University. It is a 4-semester course that turns the teaching laboratory to a platform for exploration. The keys for success of this program are due to the concepts of (a) doing teaching R&D, treating students as friends; (b) setting up long term goals & visions; (c) properly designing issues and using later issues to integrate former issues; (d) training TAs & reviewing student performance with TAs each week before the class; (e) reorganize each team and its leader every semester; and (f) emphasizing the concepts of system cost, handling frustration, problem solving, systematic thinking, team management, and realizing the key of dynamical balance.

At the last part of my presentation, I gave my full support to establish the International Nano Olympiad because it is a great idea to provide the platform for college students to learn problem

solving, systematic thinking, team management, realizing the key of dynamic balance, in the mean time learn the importance of system cost and to handle frustration. I strongly recommend establishing the international Nano Olympiad under ANF with the following four reasons: (1) the Competition will urge members to design college curricula applying “Nano” to resolve issues for social and economic development. (2) The Competition will inspire researches to involve, in addition to pursuing new knowledge, heavily with the ‘societal needs and support local industries’. (3) The Competition will promote the universities to demonstrate to the public the efforts needed to achieve ‘Sustainable Development’. And (4) The Competition will play a major role in K-12 education to achieve the ‘individualize children’s learning’.

### Thailand

#### Nanotechnology Education in Thailand

**Presented by Dr. Sirasak TEPARKUM (Nanotec) and Dr. Wiyong KANGWANSUPAMONKON (Nanotec)**

To raise awareness and disseminate knowledge of nanotechnology to the public at large. A strategy that is important and it is necessary to inform the public the importance and benefits of nanotechnology. This is particularly relevant in a variety of disciplines since science has developed various technologies. In order to study, learn and understand more about nanotechnology, it is absolutely necessary to have a mechanism to effectively communicate with the public and increase coverage of this technology information.

National Nanotechnology Center (NANOTEC) as the national agency is responsible for research and development as well as technology transfer. In addition, enhancement of understanding of nanotechnology to various target groups is also one of its mandate. In order to implement a public awareness campaign that result in creating a multiplier effect, NANOTEC proceeded to develop a facilitator networks for nanotechnology known as Training for the Trainers in Nanotechnology (TTN). In the beginning stage TTN target group covers primarily students and teachers. However, the target audience group have expanded to communities, households, and industries.

During the phase 1 of the TTN operation which is from 2008 – 2012 the number of educator network available to provide knowledge was 124 people. These trainers have accomplished to train a total of 200,000 people in specific target groups. The trainers utilized a number of communication tools from curriculum development, teaching, to organizing science camp and exhibitions. Development of teaching materials and creative inventions were conducted in the form of students science projects.

After 5 years of successfully working together to increase public awareness of nanotechnology the TTN members jointly decided it was time to move to the next phase of its operation which is to become a systematically network entity. This is when it was decided that the group needed to form a "network to network" approach. The idea stems from the fact that each TTN members already have their own network within their respective communities. The TTN members decided to establish 4 regional Nano Plus+ Centers in Thailand (North, Northeast, Central, and South). The centers have been in operation since 2012.

Currently there are 100 Nano Plus+ members who have managed to provide information on nanotechnology to 65,000 people from various sectors.

The public awareness activities by the center members to disseminate knowledge are as follow:

1. Project development facilitator.
2. Regional contest
3. Dissemination of knowledge about nanotechnology to the textile community.
4. Project Development Facilitator for teaching about the safety of nanotechnology with guidelines from NANOTEC
5. Conducted Nano Plus+ Annual Conference and nanotechnology project contest in 2512.
6. Conduct student One Day Camp.
7. Conducted trainings to vocational teachers and students.
8. The pilot program in schools for teaching about NanoSafety in 2015



9. Incorporating nanotechnology awareness in STEM education.
10. Conducted panel discussion seminars on “Integrating Public Awareness of Nano Safety Education in the 21st Century”.
11. National Science Contest on Nanotechnology 2016.
12. Transfer of knowledge about nanotubes.
13. Promote and encourage community innovation contest activities.
14. The pilot school project on knowledge of Nanosafety. NanoPlus+ Center is working with communities which have identified four subprojects.
  - 14.1 nanotechnology products safety
  - 14.2 training and awareness of safety of nanotechnology in community.
  - 14.3 education of safety of nanotechnology in community
  - 14.4 Science Camp integration focusing on safety and ethics of nanotechnology and nanomaterials in community.

The public awareness activities of NANOTEC, TTN, and Nano Plus+ Centers since 2008 – 2015 have reached a total of 265,000 people. The members of the NanoPlus+ Center have increased to 223 people who can play the role of educators and speakers.

## **Appendix 1. Participating countries and attending experts**

### **ANF Representative**

**Lerwen LIU**



*Managing Director of NanoGlobe Pte Ltd Founding Secretary of Asia Nano Forum*

*Adjunct Associate Professor, Faculty of Engineering, National University of Singapore*

[www.nano-globe.biz](http://www.nano-globe.biz)

*Email: lerwen@nano-globe.biz*

Dr Liu has a PhD in physics specializing in many-body effects and transports in semiconductor nanostructures, and has conducted research work in Australia, Italy, Japan, Singapore and USA. She has written numerous reports providing insights on nanotechnology policy, R&D and business trends in the Asia Pacific region. With her global network, coupled with her technology/industry insights and strategic mind, Dr Liu has been providing business development services to clients from government, corporations, start-ups and investors. Dr Liu is an evaluation panel member for the Proof-of Concept (POC) grant scheme of the National Research Foundation (NRF) and the Technology Innovation Fund of Ministry of Education of Singapore. She has been recognized by the World Islamic Forum, Islamic Development Bank, Asia Development Bank, United Nation organizations and various government funding agencies around the world as a key expert in innovation and emerging technologies & industries. Since 2014, she has ventured into the education sector promoting the adoption of innovation enabled by nanotechnology. In her work with undergraduate students at the National University of Singapore she developed an innovative methodology in training innovation & entrepreneurship with a holistic mind-set for solving problems related to sustainability of humanity.

**Iran**

**Ali BEITOLLAHI**



*Full Professor,*

*School of Metallurgy and Materials Eng.*

*Iran University of Science & Technology (IUST)*

*Email: beitolla@iust.ac.ir*

**Academic Background**

- PhD, Leeds University, Materials Science, U.K. 1992.

- Post Doc., Leeds University, U.K .1992- .

### **Professional Activities**

- Materials and Energy Research Center (MERK), Tehran, Iran, 1982-1986, as research assistant.
- Leeds University, School of Materials, Thin Film Group, 1992- as Post Doc.
- Professor at Dept. of Metallurgy & Materials Eng, IUST, 1993-till now.
- Supervised more than 80 MSc and 12 PhD students on advanced and nanomaterials.
- Published more than 170 papers in different national and ISI journals.
- Member of INIC council since 2005.
- Director of Iran nanotechnology standardization committee.
- Director of international collaboration committee, INIC.
- 

### **Saeed SARKAR**

*Full Professor*



*Department of Medical Physicist and Biomedical Engineering*

*Tehran University of Medical Sciences, Tehran, Iran*

*Head of Research Center for Science and Technology in Medicine (RCSTIM),  
Tehran, Iran, Presidency Secretary General of Iran Nano Technology Initiative*

*Council(INIC)*

*Email: sarkar@tums.ac.ir*

### **Academic Background**

<b>1994</b>	Physics Department  University of Surrey, Guildford, UK, GU2 5XH  Ph.D. Degree in Medical Physics(Nuclear Medicine)
<b>1998</b>	Physics Department  University of Surrey, Guildford, UK, GU2 5XH  MSc in Medical Physics
<b>1979-1984</b>	College of Science,

Kashan University, Kashan, Iran

BSc in Physics

### **Professional Activities**

- Secretary General of Iran Nano Initiative Council, Presidency, 2008 till now
- Head of Research Center for Science and Technology in Medicine (RCSTM), 2002 till now
- Head of Health Physics, Tehran Univ. of Medical sciences, since 1996
- Head of Medical Physics Dep., Tehran Univ. of Medical sciences, from 1997 till 2004
- Supervised more than 30 MSc and 10 PhD students
- Published more than 70 papers in different national and ISI journals and more than 40 national and international published abstract and 2 books.
- Published 20 International Patents and 2 National.
- 

### **Kazakhstan**

#### **Lazzat A. Kussainova**

*Deputy Chairman of the Committee of Science*



*Ministry of Education and Science of the Republic of Kazakhstan.*

*Email: KLazzat@mail.ru*

PHD of Law (1998), Master of the Public Policy (2013);

Work experience

- 32 years work experience in civil service
- 20 years Since 1993 engaged in research and teaching activities;

Since 2010 - in the position of the Deputy Chairman of the Committee of Science of the Ministry of Education and Science of the Republic of Kazakhstan;

Held positions in the Parliament of the Republic of Kazakhstan, Administration of the President of the Republic of Kazakhstan, Supreme Court of the Republic of Kazakhstan.

### **Korea**

**Eung-Sug LEE**



*Tenured Principal Researcher*

*Korea Institute of Machinery and Materials (KIMM)*

*Vice-President, Korea Nano Technology Research Society(KoNTRS)*

*Email: eungsug@kimm.re.kr*

Dr. Lee, Eung-Sug has made a significant contribution for the development of nanotechnology in both research and policy fields. He has made remarkable research in nanoimprint lithography technology through University-Institute-Industry collaboration. Moreover he played a leading role in establishing networks of nano researchers and vitalizing nano communities.

**Academic experience**

Korea Advanced Institute of Science and Technology, Ph. D. (1990-1997)

Seoul National University, Mechanical Engineering, M.S. (1980-1982)

Seoul National University, Mechanical Engineering, B.S. (1976-1980)

**Job Experience**

Vice President, Korea Nano Technology Research Society (2016-2017)

Vice President, Korea Institute of Machinery and Materials (2014-2015)

Tenured Principal Researcher, Korea Institute of Machinery and Materials (1983-Present)

Director, Division of Nano & Convergence Technology, National Research Foundation of Korea (2009-2011)

Cross-appointed professor, KAIST, Mechanical Engineering (2010-Present)

Professor, University of Science and Technology, Nano-Mechatronics (2004-2009)

Cross-appointed professor, Chungnam National University (2002-2004)

Post Doc. University of California, Berkeley (1998-1999)

President, Korean Society of Precision Engineering (2013)

Member, The National Academy of Engineering of Korea (2011-Present)

## Jun-Sung KIM



*CEO, Biterials Co., Ltd.*

*Email: lifeisgood@biterials.com*

### Academic Career

2006	Seoul National University, Republic of Korea	Ph.D. in Veterinary Toxicology
2002	Seoul National University, Republic of Korea	MS in Veterinary Toxicology
2000	Seoul National University, Republic of Korea	D.V.M. in Veterinary Medicine

### Professional Experience

2009 - present	CEO	Biterials Co., Ltd.
2006 - 2008	Director of technique	Biterials Co., Ltd.
2010 - 2011	Commissioner	Nanosafety Advisory Committee, MFDS
2010 - 2011	Commissioner	Nanotechnology Advisory Committee, MOTIE
2009 - 2010	Commissioner	Nanosafety Advisory Committee, NRF
2002 - 2006	Senior Researcher	College of Veterinary Medicine, Seoul National University

## Malaysia

### Daniel Bien Chia SHENG



*Vice President*

*NanoMalaysia Berhad*

*Email: daniel.bien@nanomalaysia.com.my*

Dr. Daniel Bien Chia Sheng now serves as a Vice President of Innovation Office in NanoMalaysia Berhad, a lead agency under the Ministry of Science,



Technology and Innovation (MOSTI) to drive nanotechnology ventures and commercialization in Malaysia. He receives his PhD from the Queen's University of Belfast, United Kingdom and in his previous appointments, he serves as the Head of Nanoelectronics Centre of Excellence at MIMOS Berhad, a lead R&D agency under the Ministry of Science, Technology and Innovation (MOSTI) focused in driving the National Nanoelectronics Roadmap and prior to that, he serves as an R&D Specialist in Philips Lumileds Lighting Company Malaysia overseeing all development of silicon based LED products in Malaysia.

With his vast experience in the area of Nanoelectronics and Nanotechnology, he chairs the National Mirror Committee for the International Electrotechnical Committee, IEC TC-113 on Nanotechnology Standardization for Electrical and Electronic Product and Systems for Malaysia from 2010 to 2015; and has filed more than 50 international patents and technical publications respectively.

**Kamarulzaman KAMARUDDIN**



*Principal Assistant Secretary ( Deputy*

*Director) National Nanotechnology*

*Directorate(NND), Ministry of Science,*

*Technology & Innovation, Malaysia*

*Email: kamarulzk@mosti.gov.my*

Competent and Knowledgeable Senior Research Scientist in the area of:

- o Microbiology
- o Biochemistry
- o Enzymology
- o Analytical Biochemical Sciences

Competent and Knowledgeable Analyst/ Consultant in the area of Organizational Strategic Planning.

Knowledgeable Analyst/ Consultant in the area of Strategic Business Development and Business Intelligence.

Research, Development, Commercialization and Innovation Section Head

- a) R&D Planning, Collaboration and Networking for inter agencies /industries at National, Regional and Global Level
- b) To plan, evaluate and monitor implementation advancement of R, D & C for Nanotechnology
- c) o uptake the task of evaluating and identifying the Industrial Needs in terms of Technology, New Product and Process Development for Nanotechnology to increase global market competitiveness

d) To plan and implement International Collaborative Programs regarding Industrial Development of Nanotechnology, Technology Development and Transfer, Safety , Standards, Regulatory and Accreditation Developmental Activities.

**Nur Aainaa Syafini Binti Mohd RADZI**



*Head, NANO Verify Programme*

*NanoMalaysia Berhad*

*Email: aainaa@nanomalaysia.com.my*

Dr. Nur Aainaa Syafini binti Mohd Radzi is the Head of NANOVerify Programme, the very first voluntary nano-certification program in Malaysia, and the sixth program of its kind in the world. She is the key liaison in ensuring the alignment of the program for international acceptance with other Asian nano-certification bodies (NanoMark Iran, NanoMark Taiwan and NanoQ Thailand) and also the member of ISO/TC229- Nanotechnologies in Malaysia. In NanoMalaysia, Dr. Nur Aainaa also hold a responsibility as the Manager for NanoMalaysia-IBM Joint Development Program in Healthcare & Wellness.

Graduated her PhD in 2013 from the University of Malaya (UM) in Environmental Pollution. She also has a Bachelor Degree in Marine Science from University Malaysia Terengganu (UMT) majoring in Aquatic Environmental Pollution. She was a Yayasan Khazanah scholar from 2009 to 2013.

**Russia**

**Anastasia GRIGOREVA**



*Professor assistant at Lomonosov Moscow State University*

*Email: anastasia.grigorieva@gmail.com*

**Academic experience**

Moscow State University, Moscow, Russia	Chemistry, Physics and Mechanics of Materials	B.S.	2004
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	Chemistry and		2006
Moscow State University, Moscow, Russia	Materials Science	M.S.	
Moscow State University, Moscow, Russia	Inorganic Chemistry and	Ph.D.	2009
	Solid State Chemistry		
	Chemical Engineering	Postdoctoral Fellow	
Lawrence Berkeley National Laboratories, UC Berkeley, Berkeley, US			2010-2011
	Materials Science and Nanotechnology	Senior Researcher	2011-present
Moscow State University, Moscow, Russia			

2011–Present Senior Researcher, Deputy Dean for International Cooperation, Department of Materials Science, Lomonosov Moscow State University, Moscow, Russia

2010–2011 Postdoctoral Fellow, Lawrence Berkeley National Laboratories, University of California at Berkeley, Berkeley, USA

2009–2010 Postdoctoral Fellow, Department of Materials Science, Lomonosov Moscow State University, Russia

**Sergey Yurievich VOLKOV**

*Autonomous Nonprofit Organization «Center of certification of products and management systems in nanoindustry»*



*(ANO «Nanocertifica»)*

*Email: volkov@nanocertifica.ru*

Mr. Volkov has necessary competencies and experience in the field of nanotechnology, specializing in the assessment and conformity assessment of products of nanotechnologies, knows the main directions of development of innovative technologies, the kinds and groups of products of nanotechnologies, basic product requirements, as well as normative-legal acts and documents of technical regulation (confirmation of compliance, standardization, accreditation, supervision), metrology.

### **Andrey MELNIKOV**



*Senior Expert, FIEP (RUSNANO), Anastasiya Grigorieva, Researcher, Material Science Department, Moscow State University. Nano Education and Nano Competition Experience. Russian Federation.*

*Fund for Infrastructure and Educational Programs*

*Email: andrey.melnikov@rusnano.com*

Andrey Melnikov, Child Psychologist, a Master of Education in Educational Policy and Management (The University of Manchester & Moscow Higher school of Social and Economic Sciences). During several years was involved in series of international projects devoted to school management, teacher effectiveness, assessment in education etc. My main areas of research interest are child development, digital educational technologies (especially game-based-learning) and comparative analysis of educational systems in different countries.

Nowadays job responsibilities are project management (coordination and monitoring) in educational programs and projects, mostly in school sphere, in order to develop personnel training system in Russian nanoindustry and to involve into STEM education young people; TOR design; negotiations with contractors, partners, press/media; reporting and presenting within the professional conferences, workshops etc., organization of meetings, workshops and conferences.

### **Taiwan**

**Maw-Kuen WU**



*President*

*National Dong-Hwa University Academician, Academia Sinica*

*E-mail: mkwu@phys.sinica.edu.tw*

**Education:**

1981 Ph. D., Physics, University of Houston, USA

1975 M.S., Physics, Tamkang University, Taiwan

1973 B.S., Physics, Tamkang University, Taiwan

Prof. Maw-Kuen Wu is currently a distinguished research fellow at the Institute of Physics, Academia Sinica in Taiwan. He is a world-renowned scientist specialized in superconductivity. Prof. Wu has received many major scientific awards including the US National Academy Comstock prize, the Humboldt Research Award, the Nikkei Asia Prize, and the Presidential Science Prize of Taiwan. He was elected as a member of the Academia Sinica in 1998, and in 2004 was elected to the US National Academy of Sciences as a Foreign Associate, as well as a member of the Academy of the Developing Countries. In addition, he served as a member of the cabinet in charge of science and technology in Taiwan, from 2000 to 2002, he was the Deputy Minister, and from 2004 to 2006, the Minister of the National Science Council (NSC) of Taiwan, and served as the Director of the Institute of Physics in Academia Sinica, Taiwan from 2006-2011. In 2012 – 2016 he served as the President of the National Dong Hwa University in Taiwan.

**Thailand**

**Sirasak TEPARKUM**



*Deputy Executive Director, NANOTEC*

*National Nanotechnology Center/ National Science and Technology Development Agency*

*Email: sirasak@nanotec.or.th*

Dr. Sirasak Teparkum, the Deputy Executive Director Of the National Nanotechnology Center (NANOTEC), has long experience of various technology transfer projects created both income

and economic impacts to Thailand more than 7 Billion Baht. Before joining NANOTEC, he worked at the National Center for Genetic Engineering and Biotechnology (BIOTEC), National Science Technology Development Agency (NSTDA) as a technical officer responsible for science communication, disseminating scientific information to the public thru writing articles, creating science media, giving scientific presentation for the public, and organizing science exhibitions. He wrote more than 30 published articles, edited 11 books, created science media so called, “Genomic Music” which DNA is decoded and transformed into a truly music of life. In 2004, Dr. Sirasak was transferred to NANOTEC and selected to be a member of working group in the National Nanotechnology Strategic Plan; and in 2010 he was selected to be the secretariat to establish National Nanosafety Strategic Plan. Presently, Dr.Sirasak Teparkum is responsible for directing the Technology Transfer and Business Development Division and R&D Supporting Unit Division. He is also selected as the Secretary General of Nanotechnology Association of Thailand. Dr. Sirasak Teparkum received the Bachelor degree of

Horticulture at Kasetsart University and B.Sc. in Biology from Concord College, West Virginia. Afterwards, he pursued his graduate levels, Master and Ph.D, at Virginia Polytechnic Institute and State University in the field of plant tissue culture and plant-insect molecular interaction.

### **Wiyong KANGWANSUPAMONKON**



*Senior Researcher*

*National Nanotechnology Center*

*National Science and Technology Development Agency*

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Wiyong completed his PhD in Materials Science from the Chulalongkorn University, Thailand in 2004. He is a principal researcher at National Nanotechnology Center (NANOTEC), NSTDA. He was a senior researcher and a Hybrid nanostructure and nanocomposite lab head between 2010-2015. Currently, he works as a director of Nanostructure and Nanometrology Research Unit, NANOTEC. His research interests are in the areas of synthesis and characterization of nanomaterials and polymer composites. He has contributed of more than 30 scientific publications and more than 30 patents.