



Online 17<sup>th</sup> ANF Summit, 8. October, 2020

# Asia Nanotechnology Leaders

Shaping the Future of Science & Technology for Socio-Economic Well-Being

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.

## ANF mission

To promote responsible development of nanotechnology that educationally, socially, environmentally and economically benefits each economy by fostering international network collaboration.

## ANF objectives

- Foster nanotechnology in the region by creating mechanisms to share information, human and physical resources and expertise
- Support regional economic and environmental development through joint projects addressing major regional issues, with an emphasis on support of developing and emerging economies
- Coordinate joint investment in and mutual access to major infrastructure by member economies
- Promote and coordinate standardization and safety of nanotechnology concepts and measurements
- Act as an advocacy group for nanotechnology in the region and for adequate regional representation of nanotechnology at global forums
- Initiate, promote and manage co-operative scientific and technology research projects within the member economies
- Enhance public awareness and education of nanotechnology and associated social, environmental, health and economic issues

## ◆ Working Groups

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### User-Facility Network

Coordinator:

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### Nano Safety and Risk Management

Coordinators:

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## Overview

Through the collaborative efforts of all members last October, we are grateful to have a successful 17<sup>th</sup> ANF Summit and conjunctive events including Advanced Materials Forum, 4<sup>th</sup> EU-Asia Dialogue on Nanosafety, and Commercialization Workshop. As a follow-up of the EU-Asia Dialogue, the kick-off meeting of an international network-initiative was also held online later in December to expand the common knowledge base for (nano)materials of regulatory significance and to support the needs of various stakeholders including regulatory bodies and industry.

We would also like to thank all members for their support in publishing this issue of newsletter. In this February issue, we collect much about country's progress with nanotechnology, such as *ICNS 2020* (Iran), *TIA Symposium* (Japan), *Philippine National Standards* (PNS), *Working Item Proposal* (PWI) at ISO/TC229 (Taiwan), *Nanosafety Network for Industry* (Thailand). In addition, we are glad to have contributions from TERI of India, our new member, to share with us their latest progress, especially *the guidelines for evaluation of nano-based agri-input & food products*.

We expect more topics and activities to be featured in the future. Alternatively, information on latest developments and activities from ANF community are welcome to be disseminated through our website, too. Looking ahead to the year of 2021, we also expect events like NANO KOREA 2021 and postponed NanoThailand 2020, and of course, the 18<sup>th</sup> ANF Summit in Thailand would be held as scheduled after pandemic slowdown.

Ting-Kuo Lee  
President, Asia Nano Forum



## Activities in Member Countries

### INDIA

#### TERI Deakin Nanobiotechnology Centre

India, among top 3 countries in nanotechnology, is ready to forge ahead at global level by having first 'Guidelines for Evaluation of Nano based Agri-input & food products in India' intended not only to ensure quality, safety and efficacy of these products but also to ease product development in nano agri and food sectors.



Dr Harsh Vardhan, Hon'ble Minister for Science & Technology, Earth Sciences and Health & Family Welfare and Shri Narendra Singh Tomar Hon'ble Union Minister for Agriculture & Farmers Welfare and Rural Development & Panchavati Raj jointly released the First "Guidelines for Evaluation of Nano based Agri-input and food products in India" on 7th July 2020. These guidelines are developed by Department of Biotechnology (DBT), Ministry of Science and Technology, Ministry of Agriculture and Farmers' Welfare and Food Safety and Standards Authority of India, Ministry of Health and Family Welfare and is an outcome of all concerned Inter-Ministerial efforts coordinated by DBT.

TERI-Deakin Nanobiotechnology Centre (TDNBC) has played an active role in conceiving and preparing this along with DBT. These guidelines are aimed at providing science based information to help make policy decisions by providing information on the existing regulations for nano-based products in agriculture and food and also to ensure quality, safety and efficacy of the targeted products.

TDNBC was established in 2010 by signing an MoU between India's research think-tank TERI and Australia's Deakin University with a vision to identify and develop novel approaches of farm profitability through application of nanobiotechnology while conserving natural resources. Since its inception, TDNBC has been making significant strides in developing nanonutrients, nanopesticides and nanoformulations to develop targeted solutions for global challenges such as soil health, food security and water safety. The Centre is now uniquely poised to deliver path breaking technologies and products using biologicals interwoven with nanotechnologies and biocompatible materials. Simultaneously, the TDNBC projects dealing with development of nanoproducts; and safety and life-cycle assessment of nanoproducts are shouldering the

scientific and social responsibilities of providing safe and sustainable solutions to mankind. Such activities are being pursued jointly through strategic collaborations with Deakin University and over 26 academic and industrial partners worldwide across various research streams. TDNBC's research has been recognized through national and international conference presence, multiple awards to PhD students and faculty members. In the last decade TDNBC has produced over 120 Research publications in most reputed journals, 8 granted patents and 5 new patent applications and 26 externally funded projects to its credit.

Centre's research efforts have been recognized by the Government of India in the form of support for National Centre for advanced research in Agri-nanotechnology which has its key focus on innovation of safe and efficacious green nanoproducts and technologies including nano-fertilizers, nano-pesticides and nanocarriers. These products have been tested as per the existing international (OECD) and national guidelines and have been found to be safe and non-toxic to human and environment. Production technology for these nanofertilizers has also passed all the tests at pilot scale and TDNBC is now ready for mass production.

#### **4<sup>th</sup> International Conference on Nanobiotechnology for Agriculture NANOFORAGRI 2020**

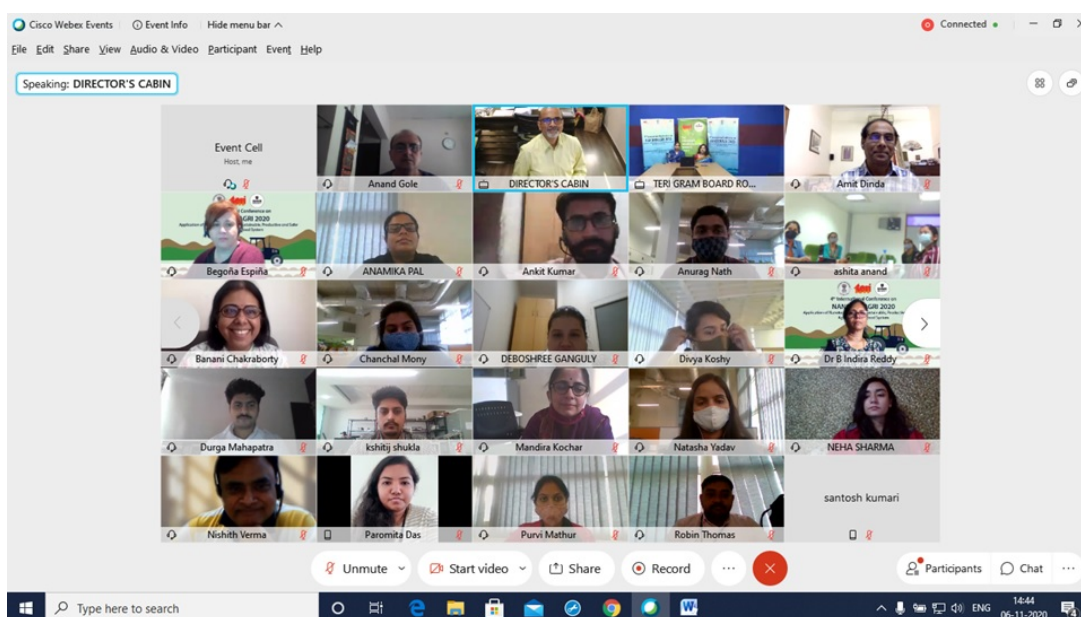
“Application of Nanotechnology for Sustainable, Productive and safer Agriculture and Food System”  
5-6th November, 2020

(Organized by TERI-Deakin Nanobiotechnology Centre, India in collaboration with Department of Biotechnology, Govt of India)



NanoforAgri 2020 has provided an interactive arena for networking of researchers, building collaborations, and a platform for budding young scientists and research scholars. Thematic talks and discussions in the conference focused on various aspects of nanotechnology for enhancement of crop nutrition and its protection, post-harvest management, food preservation, toxicity of agri-nano products and regulatory and compliance challenges for translational research in food and agriculture sectors across five sessions. The Science-Society-Policy actions for Agriculture and Food Nanotechnology being spear-headed by DBT and supported by TERI were a key focus of the conference. This virtual event also saw Scientist and Scholar Oral Research Pitches providing a glimpse into some selected pioneering research projects. This conference involved thought-provoking discussions between the ~150 participants in related fields and focused on developing scientific linkages across different themes to foster innovation and targeted solution development for challenges in agricultural research. The

Conference highlighted the key areas requiring interventions and also how nano-enabled systems will help address contemporary issues in agriculture related to efficient delivery of fertilizers, pesticides and nutrients, post-harvest management, soil conservation, pathogen detection and for the farm and food sector.



## Activities in Member Countries

## ■ IRAN

### **Iran Proposed Four New International Standards in the Field of Nanotechnology**

Iran has proposed four new international standards in the field of nanotechnology to the International Standardization Organization (ISO). So far, Iran has been project leader of developing 7 international standards in the field of nanotechnology.

ISO / TC229 (ISO's technical committee on Nanotechnology) online meeting was recently held in November, 2020. Delegates from more than 20 countries participated in the event where Iran proposed the development of 4 new standards and presented a progress report of two of its ongoing international standards.

Considering the recent outbreak of the novel coronavirus, Iran presented its proposal on characterizing nanotechnology-based disinfectants as well as assessing the release of nanomaterial in nano-enhanced respirators masks.

Currently, few countries including Iran produce COVID-19 related nanotechnology products. Considering the applications and efficiency of these nanotechnology products, the proposed two standards were greatly received by the participating countries. Currently, nanotechnology-based masks and disinfectants are produced by several Iranian companies and are readily available in the market. This enforces the importance of standards in this area. The other proposal from Iran was about evaluation of the performance and durability of super-hydrophobic nano-coatings and super -hydrophobic textile containing nanomaterials. Super-hydrophobic nano-coatings have different applications and several Iranian companies produce these materials. The initial design and proposal of the aforementioned standards were prepared with the help of experts and manufacturing companies and the special support of the INIC.

In addition to the above proposals, two other international standards that are already being developed by leadership of Iran were also discussed in the meeting. "Antibacterial textiles containing nanomaterials- performance determination" is one of the Iran-led standards which was finalized and submitted for publication. Another standard that is currently being developed is "Measurement of bioavailability of nanomaterial produced in aquatic environments."

It is worth mentioning that International Committee for Nanotechnology Standardization meetings are held every six months in order to review the policies of the committee. In these meetings, members discuss new projects and standardization proposals submitted by main member countries. Iran is among the active members of the International Committee for Nanotechnology Standardization, which has so far developed seven international standards.

### **The 8<sup>th</sup> International Conference on Nanostructure was successfully held on November 18-20, 2020.**

The 8<sup>th</sup> ICNS event was originally planned to be held on 20-22 of April 2020 at the main campus of Sharif

University of Technology; however, due to the outbreak of COVID-19, an online version of the conference was scheduled for November 18-20, 2020.

International Conference on Nanostructures (ICNS) started its mission as a workshop in 2006 when researchers at Sharif University of Technology and Iran Nanotechnology Innovation Council noticed the importance of providing a meeting ground for experts, young researchers and manufactures to discuss Nanoscience and Nanotechnology. By 2012, the small biannual gathering had turned into an international event and one of the largest meetings on nanotechnology in our region.

The scientific program of ICNS8 included a diversity of topics and parallel sessions in which more than 360 papers were presented in oral or poster presentation sessions. The main topics included Low-dimensional Nanostructures, Nanobiotechnology and Nanomedicine, Nanosensors and Nanobiosensors, Nanostructures in Magnetism, Electronics, Photonics and Plasmonics, Nanostructures for Water and Environment, Nanostructures for Energy Conversion and Storage, Advanced Fabrication and Characterization Methods.

As in previous events, ICNS8 hosted distinguished scientists from different countries including Prof. Jean-Marie Lehn, Chemistry Nobel Laureate (1987) from University of Strasbourg Institute for Advanced Study (USIAS), France, Prof. Justin Gooding (Editor-in-Chief of ACS Sensors) from University of New South Wales, Australia, Prof. Nitish V. Thakor from Johns Hopkins University, USA, Prof. Jianfang Wang from Faculty of Science, Chinese University of Hong Kong, Hong Kong, Prof. Teri W. Odom from Northwestern University, USA, Prof. Norbert Koch from Humboldt-Universität zu Berlin, Germany, Prof. Nicola Pinna from Humboldt University of Berlin, Germany, Prof. Thomas Jay Webster from Northeastern University, USA, and Dr. Morteza Mahmoudi from Michigan State University, USA.

During the three-day event, more than 400 people actively participated in 9 keynote talks, 16 invited talks and 26 oral and poster presentation sessions.

#### **INIC's proposal for establishing an Asia-EU nanosafety cooperation platform was welcomed in the 4<sup>th</sup> Dialogue on Asia-EU Nanosafety and nanocertification**

Following previous three rounds of the Asia-EU dialogue on Nanosafety and nanocertification in Iran(2017), Austria(2018), and Thailand(2019), the fourth dialogue was held virtually on 7 October 2020 hosted by the Austrian federal ministry of climate action, environment, energy, innovation and technology.

It is worth mentioning that this program was initiated based on the suggestion by Iran Nanotechnology Innovation Council to European Commission in 2017 and the first event was held in Tehran in the same year by participation of representatives from European Commission of research and innovation as well as active countries from Asia and Europe.

In the 4<sup>th</sup> dialogue, Prof. Beitollahi, the senior advisor of INIC's standardization and nanosafety department, presented INIC's proposal for establishment of a cooperation platform between Asia and Europe in nanosafety called "Asia-EU Network of Networks on NanoSafety



(NONNS)". As the first step it was suggested that a founding committee be formed and start working on establishment of intercontinental network on nanosafety standardization. The proposal was welcomed in the dialogue in principle after comments and suggestions made in a panel during the dialogue and the founding committee was formed of representatives from Iran, Thailand, South Korea, Taiwan, EU nanosafety cluster and Austria to draft the concept and action plan, and present it to the European Commission.

The proposed platform is supposed to facilitate communication and cooperation in different layers of relevant players of nanosafety in the form of provision of services and conducting various relevant activities.

In the fourth dialogue, representatives from a number of Asian and European institutions participated and discussed different problems and challenges of the area, exchanged experience, and explored various ways to boost the cooperation between the two continents.

From EU, representatives from Europe Commission on Research and Innovation, European Nanosafety Cluster, Austria's Bionanonet, Nano Risk Governance Council, Malta initiative, and the Germany's Federal Institute of Occupational Safety and Health as well as the OECD participated. In addition representatives from relevant institutions from Slovenia, Denmark, Norway, Belgium, Finland, Netherland, Swiss, France, Luxemburg, Spain, England, and Italy were present in the dialogue.

From Asia also representatives from institutions including Iran Nanotechnology Innovation Council, Taiwan's Academia Sinica, Thailand's Nanotech, Philippine's Nanotech initiative, India's Nanobiotechnology Center, and the South Korea's Research Institute of Standards and Science participated.

### **Oral Nano-Curcumin Formulation, A Promising Adjuvant Treatment for the Management of Hospitalized COVID-19 Patients**

While the viral infection due to the novel coronavirus spreads globally, researchers seek to find innovative remedies to control and combat the disease.

Among these, curcumin, being an anti-inflammatory, antioxidant, and anti-apoptotic agent, has shown substantial potential to control lung inflammation due to COVID-19. For this purpose, Dr. Sepideh Elyasi and Professor Mahmoud Reza Jaafari have recently introduced a nano-formulated curcumin containing agent (SinaCurcumin) with significantly increased bioavailability.

In a recent study, forty-one patients underwent a clinical investigation with this approach for two weeks. As a result, a significant relief from some of their symptoms, including fever and chills, tachypnea, myalgia, and cough were recorded. In addition, the results indicate that oral consumption of SinaCurcumin could substantially accelerate the recovery time.

The study has been published in the journal of Phytotherapy Research. 2021; 1:8. You can

find the original article at

<https://www.ncbi.nlm.nih.gov/research/coronavirus/publication/33389761> .

## Activities in Member Countries

■ JAPAN

### 12<sup>th</sup> TIA Symposium was held on line, November 19<sup>th</sup>.

The symposium started with an opening address by the chair of TIA managing committee, Mr. Tetsuro Higashi, followed by greetings from Cabinet Office, Ministry of Economy, Trade and Industry, and Ministry of Education, Culture, Sports Science and Technology.



Then Dr. Kanemaru, the Vice President of AIST briefly introduced the activities and outcomes of TIA, and a new vision of TIA, third phase of activities.



Then there was a discussion between Prof. Yoshino, a winner of Nobel Chemistry Prize, 2019 and Mr. Higashi, the chair of TIA. The discussion was delivered in two parts. In the first part, they discussed on personnel and organization, based on the experience to utilize personnel to achieve innovation in an organization. In the second part, they discussed on the balance of fundamental research and application oriented research, and problems that hinder development of new technology and their solutions.

Next, video messages were delivered from Prof. Ohno, the president of Tohoku University and Prof. Iijima, the tenured professor of Meijo University, entitled “Findings from Professionals” to young audience.



Next, there were two achievement presentations from research fields of power electronics and quantum and optical measurements, followed by three presentations from TIA Collaborative Research Promotion Programs “Kakehashi”, 2020.

Finally, there held a panel discussion, entitled “Industry-Academia collaborations and expectations for TIA as an open innovation center.” Four panelists from, New Energy and Industrial Technology Development Organization, Japan Science and Technology Agency,



NEC Corporation, and Tohoku University gave a hot discussion on the topic. They also discussed problems that hinder good circulation of personnel, infrastructure, and funds, necessary to accelerate the development of new technology.



About 350 audience joined the online symposium.

## Activities in Member Countries

### PHILIPPINES

#### The Industrial Technology Development Institute- Department of Science and Technology Spearheads the Philippines' Development of National Standards on Nanotechnologies

The DOST- Industrial Technology Development Institute, is at the forefront of developing the country's standards for nanotechnologies. DOST-ITDI, together with the Department of Trade and Industry's Bureau of Philippine Standards (DTI-BPS), spearheaded the establishment of the National policy/standards on Nanotechnologies by conducting monthly technical committee meetings on Nanotechnologies. As of December 2020, TC-85 on Nanotechnologies have reviewed, endorsed ISO standards, published and adapted forty (40) Philippine National Standards on Nanotechnologies.

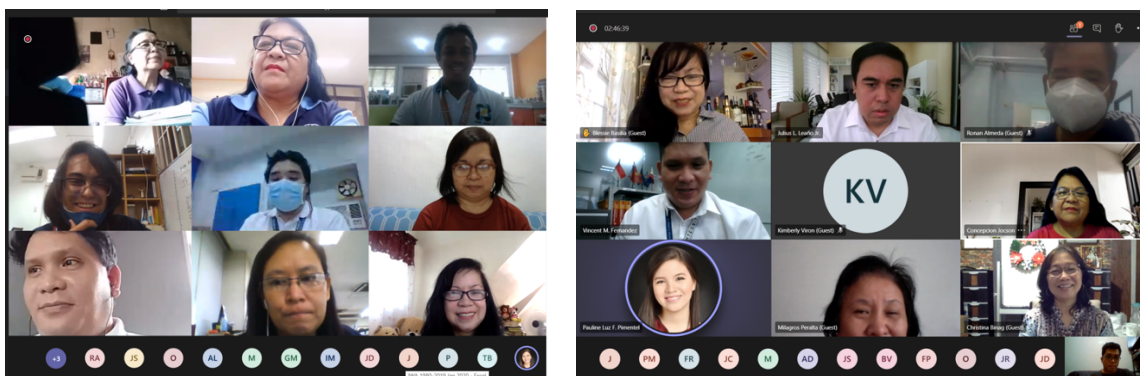


Figure 1. Screenshot of Technical Committee Meetings on Nanotechnologies (TC-85)

During the COVID 19 pandemic, the BPS Technical Committee (TC-85) on Nanotechnologies continuously work on the different standards on Nanotechnology and was able to publish a total of 21 Philippine National Standards(PNS) of which 6 PNS from subcommittee 1 (SC-1) on Measurement and Characterization, nine (9) PNS from subcommittee 2 (SC-2) on Health, Safety and Environmental Aspects of Nanotechnologies and six (6) PNS from subcommittee 3 (SC-3) on Materials Specifications.

#### Publication of Six (6) Manuals as Reference Materials developed by the Nanosafety Team of the Industrial Technology Development Institute (ITDI).

A series of manuals have been developed by the Department of Science and Technology (DOST) - Industrial Technology Development Institute (ITDI) to be available to the public at the National Library of the Philippines. The publication of these manuals as reference materials is one of the outputs of the project “Environmental, Health, and Safety Research on the Risk Assessment of Nanomaterials in the Philippines”, sponsored by DOST-Grants-In-Aid. The series consists of six (6) manuals that are based on existing international standards, protocols, and guidelines as follows:



Figure 2. Six (6) Manuals developed by the Industrial Technology Development Institute (ITDI)

### **Inauguration of the Materials Development (MATDEV) Laboratory - Philippines' First 3D Printing Laboratory utilizing Nanocomposite Filaments**

The Materials Development (MATDEV) laboratory was inaugurated last December 22, 2020. It consists of FDM laboratory, Post-processing laboratory, Chemistry laboratory, Materials Characterization laboratory, 3D Printing R & D Laboratories, and Spheroidizing Laboratory. MATDEV is ready to provide services to various stakeholders from the industry, academe, and government sectors. MATDEV's commitment to delivering innovative solutions to support manufacturing industries by the fusion of nanotechnology and additive manufacturing using our developed nanomaterials to produce filaments. The local materials developed were cheaper and had an improved property and performance as compared to the imported material. MATDEV will create different possibilities such as replacements of human parts, infrastructures that are custom-made, and others. The facility will greatly contribute to the progress of the country and to be the nation's leading R&D center for 3D printing.



Figure 3. Inauguration of the MATDEV Laboratory and ribbon cutting led by Dr. Annabelle V. Briones (ITDI Director), Dr. Blessie A. Basilia, Dr. Zorayda Ang, Engr. Reynaldo Esguerra and Fr. Reynaldo Reyes.



Figure 4. The unveiling of the MATDEV marker with DOST Undersecretary for R & D, Dr. Rowena Cristina L. Guevara and Program Leader, Dr. Blessie A. Basilia.

## First Interlaboratory Comparison on Nanomaterial Size Measurement Highlights Competence of Philippine Nanotechnology

Commercially available nanosphere standards of polystyrene with NIST traceable mean



diameters were used as interlaboratory comparison samples for the first local interlaboratory comparison for nanomaterial size measurement in the Philippines. The local interlaboratory comparison was organized in accordance with ISO/IEC 17043:2010. This comparison was participated by various testing and research laboratories in the Philippine archipelago, from the academe, government, and private companies, which have the capabilities for dimensional analysis at the nanoscale. The instruments used by the participating laboratories were Atomic Force Microscope (AFM), Dynamic Light Scattering (DLS), Scanning Electron Microscope (SEM), and Transmission Electron Microscope (TEM). Two polystyrene samples were tested by the participating laboratories, with different nanomaterial size ranges, one at 7-54 nm, and the other at 32-95 nm. The reference values and standard deviations declared in the Certificate of Calibration and Traceability of the Nanosphere Size Standards were used to compute the z-scores of the participating laboratories. The results of the local interlaboratory comparison show both the competence of some laboratories in the Philippines in dimensional measurements at the nanoscale and at the same time the needed improvement in the methodologies used by the other laboratories. A post-interlaboratory comparison meeting was conducted using the virtual platform on October 27, 2020, wherein the results of the interlaboratory comparison were presented. The participant laboratories were made aware of their z-scores (performance) and they were also trained on the proper conduct of root cause analysis and corrective action so that those laboratories with unsatisfactory results are guided on what improvements are to be done to their methodologies and laboratory quality management system.

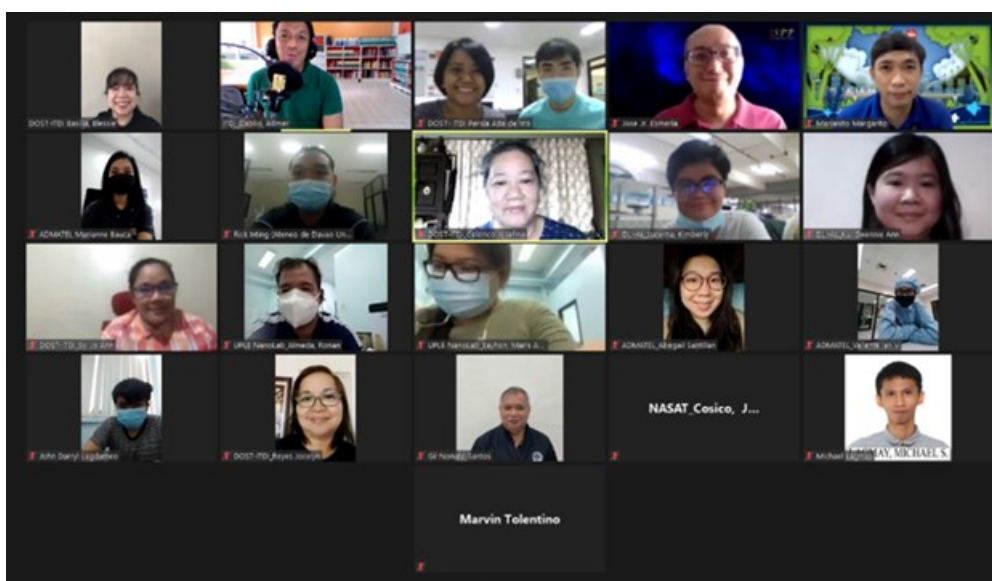


Figure 5. Screenshot of Participants during the Post Interlaboratory Comparison Meeting

### **Philippines' Young Scientist, Engr. Mar Christian Que of the Industrial Technology Development Institute (ITDI) presented in the 4th EU-Asia Dialogue on Nanosafety**

The 4<sup>th</sup> EU-Asia Dialogue on Nanosafety, from Discussions to Implementation, was virtually held on the 7<sup>th</sup> of October 2020. This workshop was focused on more synergy between Asian and European countries with respect to safe nanomaterials including standardization and test

guideline development. Engr. Mar Christian Que of the Materials Science Division of the Industrial Technology Development Institute (MSD-ITDI) presented “An Evaluation of Acute Toxicity and Aquatic Toxicity of Titanium Dioxide Nanoparticles”.

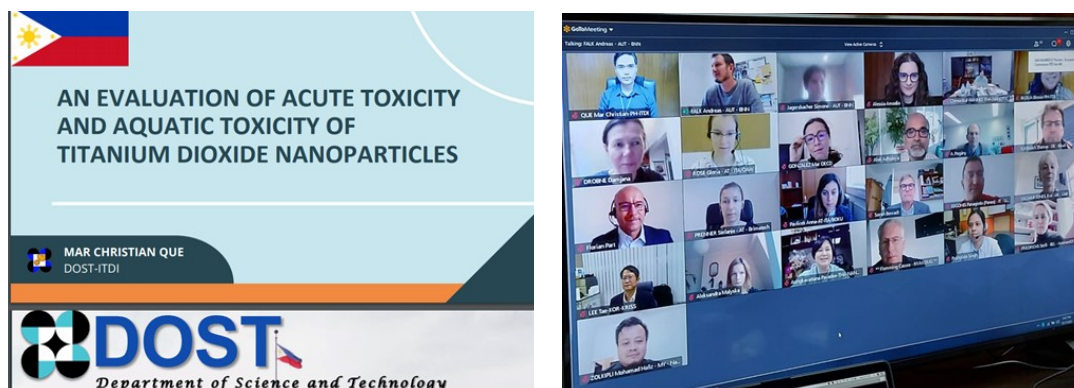


Figure 6. Screenshot of Participants during the 4th EU-Asia Dialogue on Nanosafety

## Series of WEBINARS on the Philippines' Nanotechnology Initiatives were conducted during the Covid-19 Pandemic

### 1. Mini-Colloquium on Biological and Biomedical Technologies and Materials

Mapúa University, together with the Chung Yuan Christian University of Taiwan had their Mini-Colloquium on Biological and Biomedical Technologies and Materials last January 13, 2021. Dr. Blessie Basilia under the “Environmental, Health and Safety Research in the Risk Assessment of Nanomaterials presented a paper entitled “An Evaluation of Acute Toxicity and Aquatic Toxicity of Nanoclay”.



Figure 7. Speakers for the Mini-Colloquium on Biological and Biomedical Technologies and Materials

### 2. 15<sup>th</sup> Chemical Engineering Week of the Philippine Institute of Chemical Engineers (PIChE)

The Philippine Institute of Chemical Engineers, Inc. (PIChE), the national organization of chemical engineers founded in 1939, duly accredited and recognized by the Board of Chemical Engineering and the Professional Regulation Commission (PRC) lead in the nationwide observance of Chemical Engineering Week. This year, PIChE celebrated the 15th Chemical Engineering Week on September 13 – 19, 2020 with the theme “Chemical Engineers at the Forefront of Disaster Resilience and Economic Recovery.” ITDI, through

Dr. Blessie A. Basilia, presented the research work entitled “Risk Assessment of Using Nanomaterials to Human Health”.

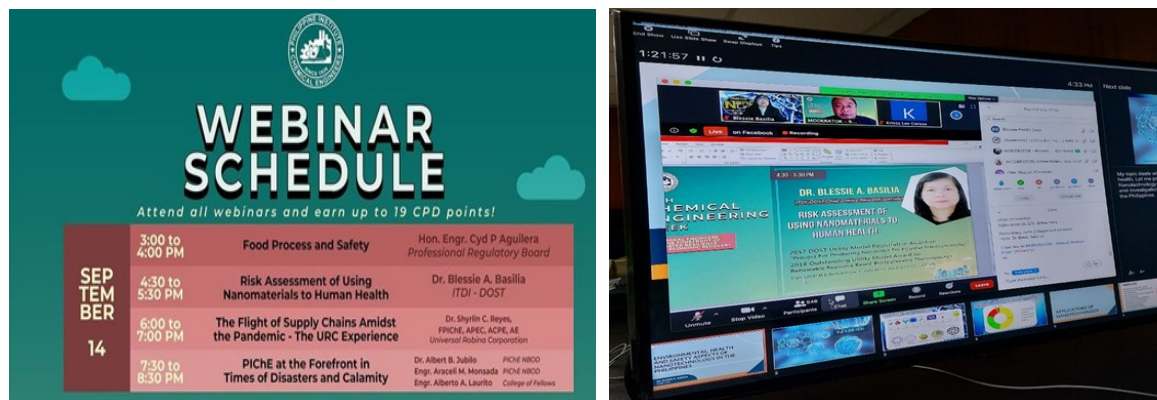


Figure 8. Screenshot Presentation of Dr. Blessie A. Basilia for the 15th Chemical Engineering Week

3. Training on the Latest Characterization Techniques of Nanomaterials at the CARAGA State University  
Scientists and professors around the globe virtually gathered on a historic training on September 16, 2020, on the latest characterization techniques on nanomaterials which were spearheaded by Dr. Rey Y. Capangpangan of Caraga State University's (CSU's) NanoCeNTRE.

ITDI, represented by Dr. Blessie A. Basilia, discussed the **“Characterization of Manufactured Nanomaterials in the Philippines”** while Dr. Drexel A. Camacho of the Chemistry Department of De La Salle University made a thorough discussion on the **“Visualizing the Nano World”**.



Figure 9. Screenshot Presentation of Dr. Blessie A. Basilia for the Training on the Latest Characterization Techniques of Nanomaterials



## Activities in Member Countries

## TAIWAN

### Taiwan participated in ISO/TC229



The 2020 ISO/TC229 Nanotechnologies Plenary Meeting was held on 13 November virtually during COVID-19 (originally in London, UK). Dr. Tsing-Tang Song, on behalf of Asia Nano Forum (ANF), has presented a Preliminary

Working Item Proposal (registered as PWI 4971) at WG5 (Products and Applications). ISO/TC229 agreed that this PWI 4971 “*Nanotechnologies - Performance Evaluation of Nanosuspension Containing Clay Nanoplates for Quorum Quenching*” should proceed to New Work Item Proposal (NWIP) ballot stage, and invited Liaison member ANF to submit the proposal by the end of December 2020, with Dr. Song proposed as Project Leader. This NWIP proposal has also been issued via the ISO/TC229 electronic balloting procedure. The voting will be closed on 5 April 2021.

### TANIDA held The Role of Nanotechnology in the Post-Pandemic Era Workshop

Facing post-pandemic era, how COVID-19 has affected such as health care, psycho-social, economic and educational, among others? What is the role of nanotechnology? The workshop organized by Taiwan Nanotechnology Industry Development Association (TANIDA) was held on 10 December 2020 at National Taiwan University in Taipei. Speakers including President Kung-Yee Liang (梁賡義) of National Health Research Institutes, Dr. Gary Wang (王崇智), CEO at Taiwan



Accelerator Plus, Prof. Jiang-Jen Lin (林江珍), Honorary Professor at National Taiwan University, and Dr. Yin-Liang Tang (湯尹良) from Eternal Materials Co., Ltd, are invited to give presentations about the impacts on public health and responses, trend of entrepreneurship, applications of nanomaterials, and industrial progress with the rapid test reagent. There were about 80 domestic participants from academia and industry in this workshop. TANIDA was founded in 2004 and aims to facilitate the integration of R&D efforts at universities, research institutions and industry to accelerate the commercialization of nanotechnology and to meet industries' needs of developing high valued-added products and technology. Dr. Ting-Kuo Lee, current President of ANF, was elected the Chairman at the 2018 TANIDA Plenary Meeting in October 2018. In early 2017 Taiwan's nanoMark established in 2003, also the world's first



nano-product certification system, was transferred to TANIDA for the professional and independent functionality after 14-year operation under the auspices of the government.

### Smart Q station improves the COVID-19 quarantine workflow

As COVID-19 became a pandemic, quarantine stations outside of emergency departments (EDs) at hospitals became necessary. It is a priority to simplify the workflow and decision-making process for physicians. We aim to demonstrate how the National Cheng Kung University Hospital artificial intelligence (AI) trilogy of diversion to a smart quarantine station, AI-assisted image interpretation, and a built-in clinical decision-making algorithm improves medical care and reduces quarantine processing times. This “AI trilogy” was applied to shorten the quarantine survey process and reduce processing time during the COVID-19 pandemic. The use of the AI trilogy facilitated the processing of suspected cases of COVID-19 with or without symptoms; also, travel, occupation, contact, and clustering histories were obtained with a tablet computer device. A separate AI-mode function that could quickly recognize pulmonary infiltrates on chest x-rays was merged into the smart clinical assisting system (SCAS), and this model was subsequently trained with COVID-19 pneumonia cases from the GitHub open source dataset. The SCAS algorithm was continuously adjusted based on updates to the Taiwan Centers for Disease Control public safety guidelines for faster clinical decision making. Our ex vivo study demonstrated the efficiency of disinfecting the tablet computer surface by wiping it twice with 75% alcohol sanitizer. The use of the AI application in the quarantine station significantly reduced the survey time. Thus, we concluded that this AI trilogy improved our medical care workflow by shortening the quarantine survey procedure and reducing the processing time, which is especially important during an emerging infectious disease epidemic. (This article is reprinted from GASE-Taiwan Research Highlight, MOST)



Figure 1: The uncertainty in the air of COVID-19 quarantine station was above our imagination. With crowded staffs in a limited space, complexity of the decision strategy and judging whether the X-ray was reported as pneumonia or not made the whole story more high-pressured.

In December 2019, a local outbreak of pneumonia caused by a novel coronavirus, also called COVID-19, disrupted our lives. This coronavirus is considered to be extremely dangerous to human beings. Person-to-person transmission has been documented for COVID-19, and prevention of in-hospital outbreaks became a pertinent issue for crowded departments with highly-infectious regions, including emergency departments (ED), outpatient clinics and inpatient admission wards. With experience of SARS in 2003, Quarantine Stations (Q stations) outside of emergency departments at most hospital had developed a strategy to deal with the emerging disease. To prepare for the screen workload inside the Q station, most staff with medical licenses were required to support the working shift. Therefore, it is crucial to simplify

the workflow and decision-making process for doctors from all subspecialist fields.

Furthermore, the dynamic situation changed every day with new CDC announcements, requiring a total of 53 immediate changing protocols. To fulfill the criteria and strategy for screening, and to shorten the process time in the COVID-19 Q station, National Cheng Kung University Hospital (NCKUH) designed an artificial intelligence (AI) system to solve these unmet clinical needs. The NCKUH AI team successfully developed a computer assisted technology device to accelerate medical decisions with their prior smart medicine research experience before the event. The goal was to reduce potentially dangerous SARS-CoV-2 exposure due to long duration times in the quarantine unit. In response to this increasing public health emergency, the NCKUH AI team developed a “smart Q station” outside of the NCKUH emergency room to facilitate the screening and survey procedure.

### Trilogy of the smart Q station

The Trilogy included: 1) diversion via the Q station; 2) a tablet computer for TOCC; and 3) an AI-assisted image interpretation with clinical strategy decision-making algorithms at the smart Q station. These steps efficiently facilitated the screening and survey process for those suspected cases at NCKUH.

For the expected high flow visit for this emerging infectious disease epidemic, NCKUH immediately decided to set up 8 temporary wartime quarantine tents for the Wuhan Pneumonia Quarantine Action. Simultaneously, a more permanent, structured house for long-term quarantine was initiated near the wartime tents. This effective diversion of patients from the ER to the quarantine tents relieved the crowded ER. On average, each medical staff member was estimated to have checked 35-50 quarantine patients per day.

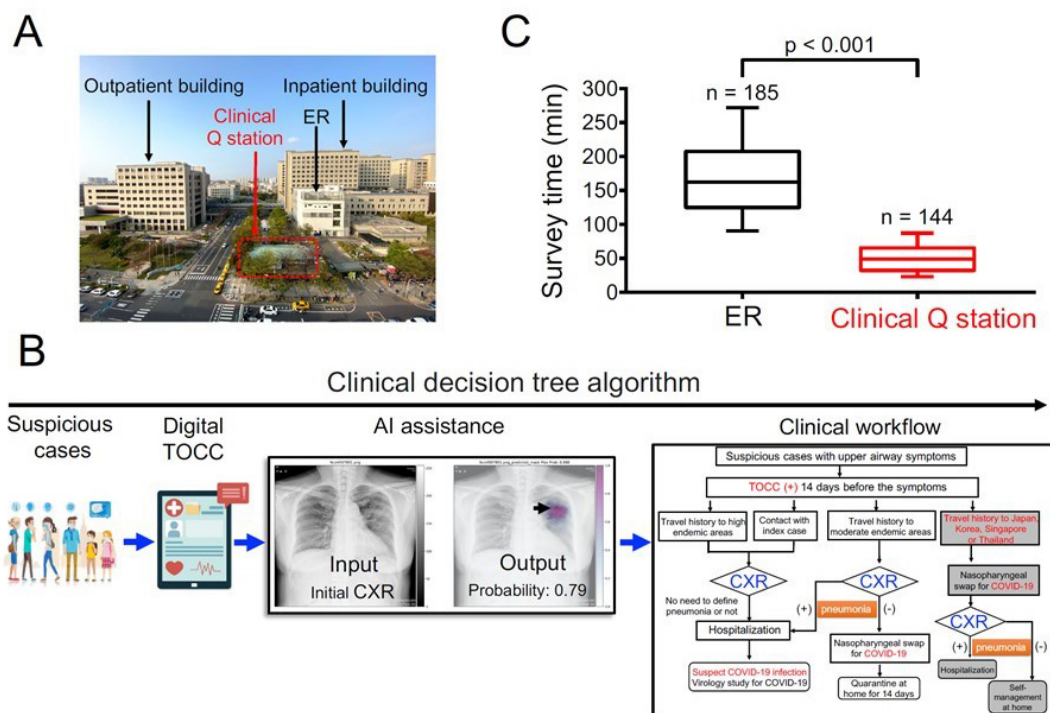


Figure 2: The trilogy of scientific prevention in National Cheng Kung University Hospital: A. First, we used the precious space of the hospital to design a quarantine station that avoids the crowds between the outpatient building and in-patient emergency building; B. We also used smart tablet computers to fill in medical records by patients and collect patients' travel, occupational, cluster and contract histories, and imbedded decision trees into the program to help doctors and nurses; furthermore, with the cooperative work from AI engineers and medical imaging physicians, we also implant a wonderful AI COVID-19 image interpretation system; C. The establishment of these processes finally reduced the time for patients at the quarantine station from 120 minutes to 20 minutes.

### **Development of AI models for chest x-ray analysis**

Development of AI models for chest x-ray analysis can ease the burden of medical staff and promote rapid triaging. In order to detect the precise location of pneumonia sites, we adopted a segmentation model with a class attention map (CAM). The pneumonia segmentation model was based on U-Net.

We thus built a quarantine station with a smart clinical assisting system (SCAS) to accelerate workflow. The SCAS is a clinical decision tree algorithm which integrates the structured format of TOCC history recordings, AI-assisted interpretation of chest X-rays, and the clinical recommended workflow. Suspected cases of COVID-19 at the quarantine station used the tablet computer for the SCAS questionnaires of TOCC history with adequate alcohol disinfection between the users. To avoid cross-infection between front-line medical staff and the patients, physicians and nurses all used independent computers.

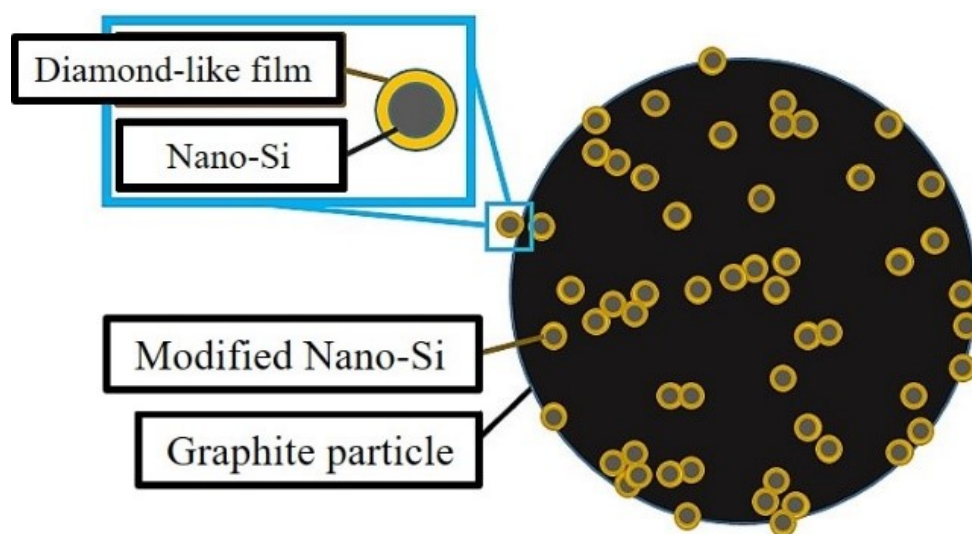
We also retrospectively retrieved 4,000 chest x-rays from our picture archiving and communication system (PACS), and identified 682 chest posteroanterior (PA) x-rays with pneumonia and 692 of normal chest PA x-rays. Our AI mode for quickly recognizing pulmonary infiltrates on chest x-rays was merged into the SCAS, with sensitivity, specificity and accuracy of 94.1%, 95.1% and 94.6%, respectively using the training dataset. Furthermore, we used cases of COVID-19 pneumonia from one open source dataset in GitHub (<https://github.com/ieee8023/covid-chestxray-dataset>) including 59 PA and 11 AP chest x-rays to test the model. We achieved the detection rate of 93.2% in AP chest x-rays.

Compared with the conventional ED track, the survey time at the clinical Q station was significantly shortened. Furthermore, the use of the AI application in the Q station reduced the survey time in the Q station. In conclusion, we demonstrated a feasible, safe and scientific way to use a smart device with an in-built algorithm, combined with an AI image system to facilitate the survey procedure, avoid cross infection, and achieve less pressure for all team members. This should be very helpful and could be adapted into our strategies for emerging endemic infectious diseases in the future.

### **Green multifunctional nano silicon powders for green energy application**

Silicon, as the most abundant material on earth, can perform multiple functions of nano-sizing and surface

modification. Through several grants from MOST, our nano-sized silicon powders have been well developed with the potential to be the key material for several futuristic green energy technologies. First, as a high capacity anode material in lithium ion batteries, the core technology includes nano-size (<80nm) coating with diamond-like shells and granulation with graphite, resulting in 5 Taiwan and USA patents. Secondly, nano-Si can be made through recycling Si from waste as a reactant to produce hydrogen upon reaction with various kinds of water solution to benefit fuel cells. Finally, SiC, as a 3<sup>rd</sup> generation semiconductor, demands high quality raw materials. By incorporating purification technology, the purity of our nano-sized Si powders can reach > 99.999%, reacting into high pure  $\alpha$ - or  $\beta$ -SiC powders. (This article is reprinted from GASE-Taiwan Research Highlight, MOST)



Numerous Nano-Si powders are attached on the surface of a graphite particle, where each Nano-Si particle is modified with diamond-like film coating as the protective layer

As the central issues in the whole world revolve around green energy and pollution, the abundant material of Silicon can be made greenish with multiple functions for miniaturizing into nano-sized silicon (Nano-Si) and surface modifications as green solutions. Better still, nano-Si can be derived from waste Si from the semiconductor and solar industries through recycling, and will not pollute the earth.

Through an international collaboration program funded by MOST in 2012, our mission to work on nano-Si was initiated in Argonne National Lab, where we learned that Si will become a strategic material in the next-generation anode material in lithium ion batteries. Si delivers the highest specific capacity, but suffers from the most serious volume expansion, which has become the most difficult issue to overcome. Supported by various MOST projects over recent years, we have been able to successfully develop nano-Si, including nano-sizing into < 80nm, conformal surface coating with a diamond-like film, granulation with graphite for a tunable surface area (as the figure), resulting in 5 Taiwan and USA patents. The most critical technology is the diamond-like surface coating, enabling nano-Si to have higher electrical conductance and higher mechanical strength for tolerating cracking through cycling compared to the most popular approach of carbon coating. The impressive results using a similar coating but on graphite have been published in *Nano Energy* 74, 104811 (2020). Ultimately, the pure nano-Si

anode can provide a discharge capacity of up to 2500 mAhg<sup>-1</sup> with the 1st cycle reversible capacity of 82% and retention of 90% over 200 cycles. For the Si/C composite anode with 8wt% Si, the specific capacity is > 500 mAhg<sup>-1</sup> with the 1st cycle reversible capacity of 90% and retention of 94% over 100 cycles, while reaching a practical packing density of > 1.5 gcm<sup>-3</sup>. The best 3Ah full-cell reaches > 80% retention over 600 cycles, when paired with a NCM 532 cathode. The Nano-Si can be further made into 1-10μm SiO<sub>x</sub> powders, by which the SiO<sub>x</sub>/C composite anode with 5 wt% SiO reaches >420mAhg<sup>-1</sup> with the 1st cycle reversible capacity of 89% and 95% retention over 100 cycles. Apparently, our developed Nano-Si and SiO<sub>x</sub> powders have reached a world-leading position.

Fuel cells, regarded as the cleanest green energy source, have been vigorously promoted; however, further advance is seriously plagued by the cost and safety of purification, storage and transportation of hydrogen. Our Nano-Si, derived from waste Si, is characterized by low cost, single crystallinity, uniform nano-size distribution, and safe handling, and can be reacted with various types of water solution with appropriate additives into high pure hydrogen. The in-situ hydrogen production without the need for storage and transportation make Nano-Si a potential way to promote the advancement of portable energy generators as well as stationary fuel cells. Besides, due to the fast-growing market in electric cars and micro-wave communications, there is high demand for SiC. Nevertheless, SiC crystal growth suffers from the need for high purity raw materials. Via the developed purification technology, single crystalline Nano-Si can be made ultra-pure with purity > 99.999%, resulting in unique features for enhancing surface reactions by lowering the melting temperature, and improving the purity and yield of SiC powders. The Nano-Si is a great choice for making low-cost and high-purity α- or β-SiC powders.



## Activities in Member Countries

### THAILAND

The National Nanotechnology Center (NANOTEC) is the leading agency on nanotechnology development in Thailand. Established on 13<sup>th</sup> August 2003, NANOTEC is one of four research agencies operating under the jurisdiction of the National Science and Technology Development Agency (NSTDA) and the Ministry of Higher Education, Science, Research and Innovation (MHESI). NANOTEC has participated and conducted various nanotechnology activities under ANF Nano Safety and Risk Management working group as following:

#### 1. Thailand joins OECD agreement on mutual acceptance of chemical safety data (MAD)

On 7<sup>th</sup> September 2020, Thailand has joined the OECD system for the Mutual Acceptance of Data (MAD) in the Assessment of Chemicals, ensuring that its non-clinical safety data related to the protection of human health and the environment will be accepted by all 44 countries adhering to MAD. The MAD system composited of a multilateral agreement that allows participating countries to share the results of various non-clinical safety tests done on chemicals and chemical products, such as industrial chemicals and pesticides. This collaboration saves governments and chemical producers around EUR 309 million annually. Participation in the MAD system requires that testing be carried out using OECD standards for test methods (OECD Test Guidelines) and data quality (OECD Principles of Good Laboratory Practice). Governments verify laboratory compliance using OECD procedures. At present, all 37 OECD countries, as well as Argentina, Brazil, India, Malaysia, Singapore, South Africa, and Thailand, adhere to the system.



#### 2. Seminar on Protecting factory workers from potential risks of nanomaterials

On 23<sup>rd</sup> September 2020, The Nanosafety Network for Industry project initiated by NANOTEC organized a seminar on "Protecting factory workers from potential risks of nanomaterials exposure" to promote awareness of nanosafety and industrial standards. Speakers included representatives from NANOTEC, the Department of Industrial Works (DIWs), and IRPC Public Company Limited (IRPC). Attendees included participants from industry and research agencies. The talk focuses on the potential risk associated with exposure of nanomaterials on workers. The risk factors are determined by the amount of exposure and toxicity. The seminar was held as part of the Department of Industrial Works Annual Conference 2020 in Bangkok.



Seminar on Protecting factory workers from potential risks of nanomaterials

### 3. New President of Nanotechnology Association of Thailand

On 26<sup>th</sup> September 2020, Dr. Wannee Chinsirikul, Executive Director of NANOTEC has been selected as the new president of the Nanotechnology Association of Thailand (NAT). Prof. Dr. Jumras Limtrakul, President of VISTEC who has been president for the past four years and now becomes an honorary advisor to the association. Dr. Wannee indicated that she is honored to be elected the new president of NAT and will follow in the footsteps of her distinguished colleagues. NAT was established in October 2010 with an aim to support and promote awareness of nanotech innovations. NAT is an important unit to issue NanoQ labels to interested local companies to help build consumers' confidence and set quality standards for products. Every 2 years, NAT will host an international conference on nanotechnology, namely “NanoThailand”.

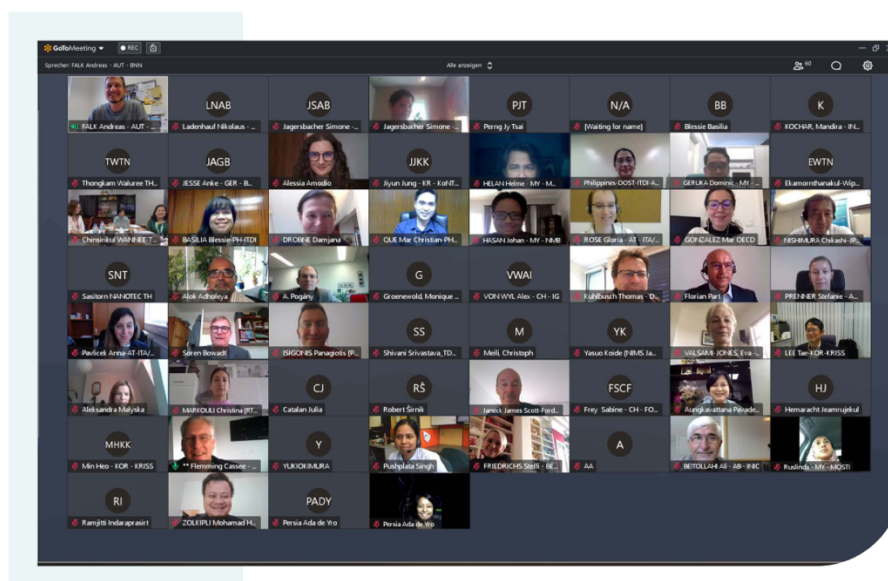


President and Members of NAT Board, Year 2020 onwards

### 4. 4<sup>th</sup> EU-Asia Dialogue on NanoSafety Advanced Materials and Emerging Issues Forum Commercialization Workshop

Due to the COVID-19 pandemic, the virtual meeting on “4<sup>th</sup> EU-Asia Dialogue on

NanoSafety Advanced Materials and Emerging Issues Forum Commercialization Workshop” was held on 7<sup>th</sup> October 2020. The number of participants from more than 20 countries joined this workshop which focusing on connecting Asian and European countries with respect to safe nanomaterials including standardization and test guideline development. Two major themes were addressed which was “The Malta Initiative” and “The proposal developed under the collaboration between EU and Asian countries”. Dr. Wannee Chinsirikul, Executive Director of NANOTEC has been selected as Co-chairs of the Malta Initiative session and a part of the Steering Group that was set up for the collaboration between ANF and Nanosafety Cluster (NSC/EU) on nanosafety.



The 4<sup>th</sup> EU-Asia Dialogue on NanoSafety Online Workshop held in October 2020.

## 5. BCG economy towards the development of packaging technology and testing models for safety

Bio-Circular-Green Economic Model (BCG) was introduced and promoted by the Thai government as a new economic model for inclusive and sustainable growth. The BCG model capitalizes on the country's strengths in biological diversity and cultural richness and employs technology and innovation to transform Thailand into a value-based and innovation-driven economy. The BCG model will focus on four industries: agriculture and food; medical and wellness; bioenergy, biomaterial and biochemical; and tourism and creative economy.

On 21<sup>st</sup> October 2020, NANOTEC and Nanosafety Network for Industry with support from Council of Scientific and Technological Associations of Thailand (COSTAT), Informa Markets, and Ministry of Higher Education, Science, Research and Innovation (MHESI) organized a panel discussion on "Bio Circular Green (BCG) economy towards the development of packaging technology" and a technical presentation on "Testing models for food safety and food contact materials" at Propak Asia 2020 in Bangkok. Panelists included Dr. Wannee Chinsirikul, Executive Director of NANOTEC, Assoc. Prof. Vane



Chonhenchob, Associate Dean for Special Projects, Faculty of Agro-Industry, Kasetsart University, Dr. Bongkot Hararak, Senior Assistance Researcher of MTEC (moderator), and Dr. Waluree Thongkam, Senior Technical Officer, NANOTEC Nanosafety Alliance Section. On the technical side, NANOTEC researchers from Nano Environment, Health, and Safety Lab (EHS) presented the following talks: "In vitro models for food safety and food contact material testing" by Dr. Ratjika Wongwanakul, researcher from Nano Environment, Health, and Safety Lab (EHS) and "In vivo models for safety evaluation of food packaging materials" by Dr. Wittaya Pimtong researcher from Nano Environment, Health, and Safety Lab (EHS).



Event - BCG economy towards the development of Packaging Technology, Propak Asia, October 2020

## 6. OECD Global Forum on Environment: Towards cost-effective management systems for industrial and consumer chemicals

On 3<sup>rd</sup> November 2020, Mr. Angel Gurría, Secretary-General OECD gave the opening remarks at the OECD virtual event on "Global Forum on Environment: Towards cost-effective management systems for industrial and consumer chemicals" in Paris, France. Mr. Ramjitti Indaraprasirt, Manager of Nanosafety Alliance Section represented NANOTEC as a panelist on the topic of "Challenges in risk management along the life-cycle of chemical (in) products: the Safe-by-design concept". His presentation focused on NANOTEC'S safety-by-design concept of promoting nanosafety awareness in parallel with technology development. Over 200 participants joined this virtual forum.

Bob Diderich, Head of Division, Environment Directorate at OECD indicated that when it comes to nanomaterials, Thailand has a dual approach from the beginning which is the promotion of innovation and the promotion of safety at the same time. The concepts and experiences in Thailand are unique and interesting for others to consider as a model. The Global Forum brings together leading actors in the field of chemicals management to promote effective engagement, collaboration, and action on the sound management of chemicals and waste.



OECD Global Forum, November 2020

## 7. Nanosafety Network for Industry announced collaborative agreement

On 9<sup>th</sup> December 2020, Nanosafety Network for Industry an initiative under NANOTEC announced the collaborative partnership agreement with nine agencies consisting of the Department of Industrial Works (DIWs), Consumer Protection Board (OCPB), Council of Scientific and Technological Associations of Thailand (COSTAT), Federation of Thai Industry (FTI), Food and Drug Agency (FDA), National Institute of Metrology Thailand (NIMT), Nanotechnology Association of Thailand (NAT), National Nanotechnology Center (NANOTEC) and Thai Industrial Standards Institute (TISI). According to Dr. Wanee Chinsirikul, Executive Director of NANOTEC, nanosafety is an integral part of nanotechnology development. The same can also be said when it comes to the safe use of nanomaterials in the industry. The safety of workers must be a priority.

The aim of this partnership is to drive the Nanosafety and Ethics Strategic Plan 2017-2021 to enhance industrial understanding and awareness of how new nano-enabled products can pose concerns regarding human health and environmental risks. In addition to use existing industrial standards related to nanotechnology, the network will also explore the implementation of other activities such as the production of industrial data base and easy to read safety publications/ manuals including participating in seminars and exhibitions.



MOU Signing Ceremony for Nanosafety Network for Industry, December 2020.

## Calendar of Events

### NANO KOREA 2021

7-9 July, 2021

Goyang, Korea

<http://nanokorea.or.kr/eng/introduce/summary.php>



**NANO KOREA 2021**

The 19th International Nanotech Symposium & Exhibition

### NanoThailand 2020

2021 (Exact date will be announced later.)

Bangkok, Thailand

<http://www.nano-thailand.com/2020/>



### nano tech 2022

26-28 January, 2022

Tokyo, Japan

<https://www.nanotechexpo.jp>



**nano tech 2022**

International Nanotechnology Exhibition & Conference

### 2<sup>nd</sup> International Nanotechnology Olympiad

2022 (Exact date will be announced later.)

Sultan Qaboos University, Oman

<https://www.nanoolympiad.org>



## Acknowledgement

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Institute of Physics, Academia Sinica, Taiwan

National Nanotechnology Center (NANOTEC), Thailand