

2023 Symposium on User-Facility Network in Asia

Presentation Text

Date: **February 2 (Thu.), 2023.** Hybrid online/onsite event, Day 2,
nano tech 2023, Tokyo

Venue: **Room 609, Conference Tower, Tokyo Big Sight, Japan**

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Federal Ministry
Republic of Austria
Climate Action, Environment,
Energy, Mobility,
Innovation and Technology

**Iran Nanotechnology
Innovation Council (INIC)**

teri | THE ENERGY AND
RESOURCES INSTITUTE
Creating Innovative Solutions for a Sustainable Future

1. BVMIT,
2. TERI,
3. INIC,
4. AIST,
5. JST,
6. NIMS,
7. KoNTRS,
8. NanoMalaysia,
9. MOSTI,
10. DOST-ITDI,
11. ITRI,
12. Academia Sinica
13. NANOTEC,
14. VAST,

AUSTRIA

INDIA

IRAN

JAPAN

JAPAN

JAPAN

SOUTH KOREA

MALAYSIA

MALAYSIA

PHILIPPINES

TAIWAN

TAIWAN

THAILAND

VIETNAM

1

ANF Working Groups

Standardization

To coordinate the cross-sector activities of ANF members for the purpose of facilitating the development of standards in the area of nanotechnology.

User-Facility Network

The purpose of the User-Facility Network working group is to advance exchange and partnership activities of professional engineers/researchers in academia and industry.

Nano Safety & Risk Management

To coordinate nanosafety activities in the region through the Asia Nano Safety Network, including harmonization of nano safety training, safety-by-design approach to nanotechnology development and translation of nano research to the marketplace. To provide a coordinated response for community concerns and engagement on nanotechnology safety and risk management issues.

Commercialization

To realise economic value of Nanotechnology Research & Development through commercialising demand driven and technology push initiatives in partnership with the industry for sustainable development of ANF member economies.

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◆Program◆

by UFN-WG

- | | | | |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|---------------------------------------------------------------------------------------|
| 13:30 | Greeting, | Yasuo Koide, NIMS, Japan |  |
| 13:35 | “Activities of Advanced Research Infrastructure for Materials and Nanotechnology (ARIM) Japan” | Chihiro J. Uchibori, NIMS, Japan |  |
| 14:05 | “Nanotechnology Hub in Kyoto Univ. -Facility and Material Data Network Hub for Next-Generation Polymers & Multi-Materials” | Toshiyuki Tsuchiya, Kyoto University, Japan |  |
| 14:35 | “NANOCAT: It’s Functional, Achievement and Contribution Towards R&D Nanotechnology Facilities, Scientific Communities and Nation” | Mohd Rafie Johan, University of Malaya, Malaysia |  |
| 15:05 | Break (10 min) | | |
| 15:15 | “Nano Characterization Facility and Network in Thailand” | Pavadee Aungkavattana, NANOTEC, Thailand |  |
| 15:45 | “Nanotechnology in Philippines: Researches, Facilities, Nanosafety and Nanotechnology Standards” | Persia Ada Yro, DOST-ITDI, Philippines |  |
| 16:15 | “Iran High-Tech Laboratory Network” | Mojtaba Nasab, Iran High Tech Laboratory Network, Iran |  |
| 16:45 | Concluding, | Ruslinda. A. Rahim, MOSTI, Malaysia |  |

Activities of Advanced Research Infrastructure for Materials and Nanotechnology (ARIM) Japan

Chihiro J. UCHIBORI

General Coordination Manager, ARIM
National Institute for Materials Science (NIMS)

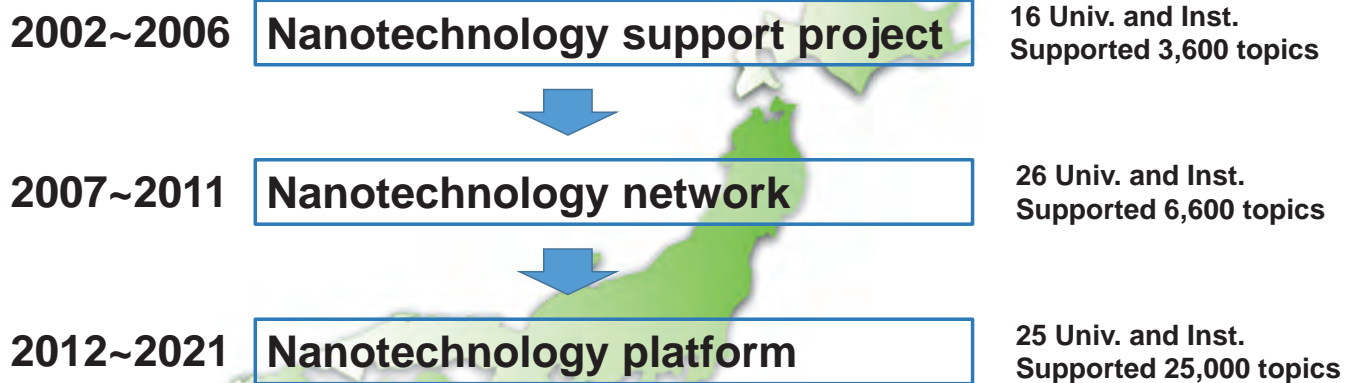
1

Outline

1. Japanese government strategy for materials innovation
2. Advanced Research Infrastructure for Materials & Nanotechnology (ARIM) project in Japan
 - ① Seven key-technology areas promoted by Hub & Spoke network scheme
 - ② Some attempts to promote use of ARIM, improve the skills and enhance the motivation of technical staffs, and enhance the motivation
 - ③ ARIM service description
 - ④ Data collection from shared user-facilities and data utilization throughout Japan
4. Summary

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Past public share-use of cutting-edge equipment project



***All of these projects were promoted by the Ministry of Education, Culture, Sports, Science and Technology (MEXT)**

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Japanese Government Strategy for Materials Innovation



- A government strategy to enhance materials innovation capacity was formulated in 2020, and “AI”, “Bio”, “Quantum”, and “Environment” fields were selected as a priority strategy.

■ Purpose

- ✓ Contribute to the world by increasing materials innovation capacity which provides for both economic development and solutions to social issues and leads the transformation to a sustainable society

■ Action plans

✓ Development and swift social implementation of innovative materials

- Development of platform consisting of academia, industry, & government to solve social issues
- Encourage the use of buried technologies owned by startups
- Strategic R&D of crucial materials technologies

✓ Encourage data-driven R&D leveraging materials, data, & manufacturing techniques.

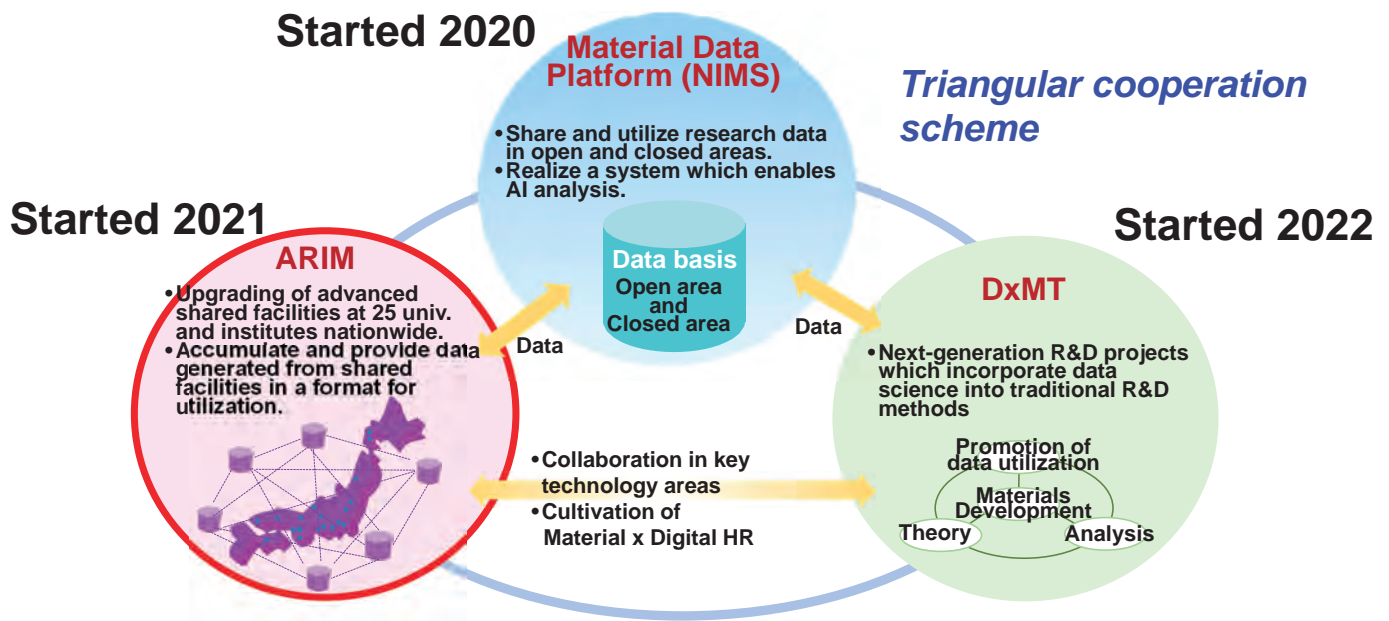
- Collect, accumulate, & utilize data for materials innovation (Develop a materials DX platform)
- Integrate manufacturing techs. & data science to develop innovative manufacturing processes

✓ Enhance international competitiveness sustainably

- Develop more robust, strategic supply chains to overcome resource constraints (i.e. rare metals)
- Achieve the circular economy
- Develop human resources
- Strategic development of international cooperation

4

Materials DX (Digital Transformation) Platform Cooperation Concept



ARIM: **A**dvanced **R**esearch **I**nfrastructure for **M**aterials and Nanotechnology

DxMT: **D**ata creation and utilization-type **Ma**terial R&D project

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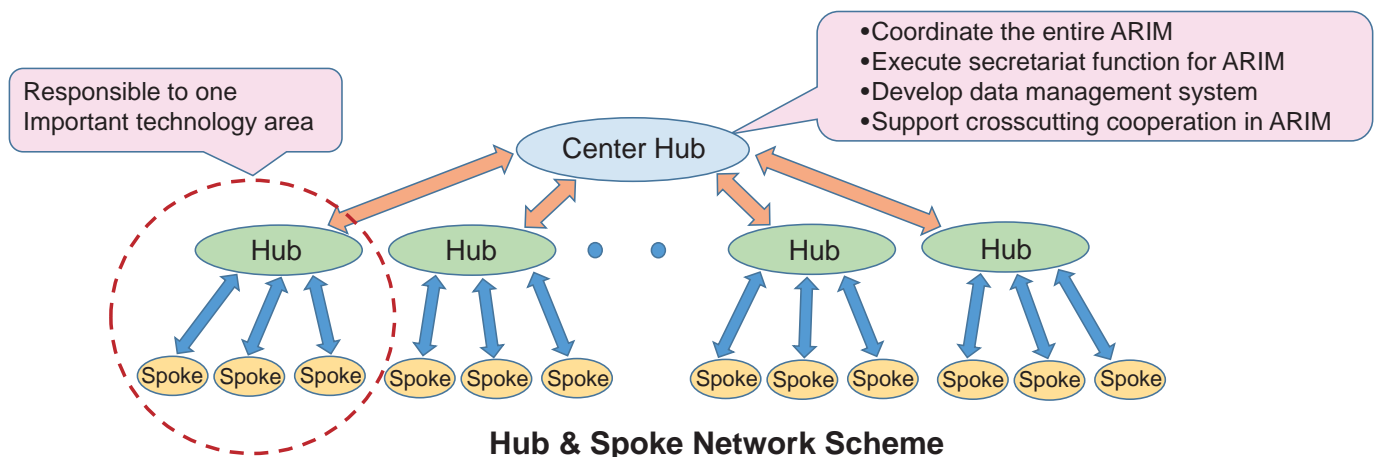
Advanced Research Infrastructure for Materials and Nanotechnology (ARIM) Projects



ARIM was launched in 2021 which consists of 25 universities & national labs.

1. The NPJ concept, which forms the user-facilities networks organized by institutions with cutting-edge equipment and research know-how, has been succeeded.








2. **Hub & spoke networks** for collecting, accumulating, and structuring **research data** which are created from observation, measurement, synthesis and fabrication equipment and facilities, was launched in order to strengthen **AI-driven materials & device R&D** using informatics techniques.



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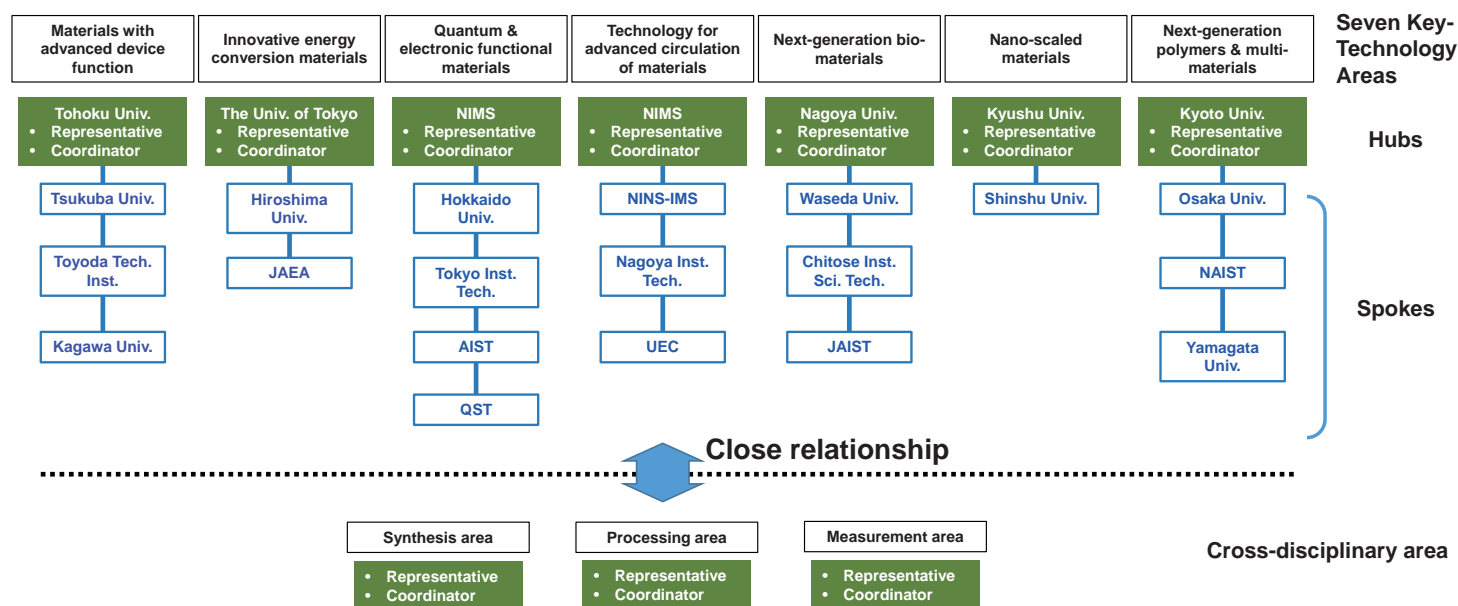
Seven Key-Technology Areas Promoted by Hub & Spoke Network Scheme



Materials with advanced device function (Hub: Tohoku Univ.)		•Contribute to data-driven R&D for advanced devices, such as MEMS and power electronics
Innovative energy conversion materials (Hub: The Univ. of Tokyo)		•Contribute to data-driven R&D for innovative energy conversion materials, such as solar cells and thermoelectric devices
Quantum & electronic functional materials (Hub: NIMS)		•Contribute to data-driven R&D for innovative functional materials created by quantum & electronic technology, such as quantum sensors/computers, photonic devices, and single electron devices
Technology for advanced circulation of materials (Hub: NIMS)		•Contribute to data-driven R&D for material reuse, reduce, recycle by synthesizing alternative & regenerative materials, and utilizing catalyst
Next-generation bio-materials (Hub: Nagoya Univ.)		•Contribute to data-driven R&D for bio-materials through realizing in-vivo experimental environment for the support of biocompatibility verification
Nano-scaled materials (Hub: Kyushu Univ.)		•Contribute to data-driven R&D for the materials with unique characteristics originating in the nano-scaled structure including nanotubes and nanosheets
Next-generation polymers & multi-materials (Hub: Kyoto Univ.)		•Contribute to data-driven R&D for the polymers & multi-materials with unique properties, such as high-strength, biocompatibility, and self-healing with the aim of integrated chemical analysis & bio-functional chips

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Organization of ARIM Japan focused on seven key-technology areas

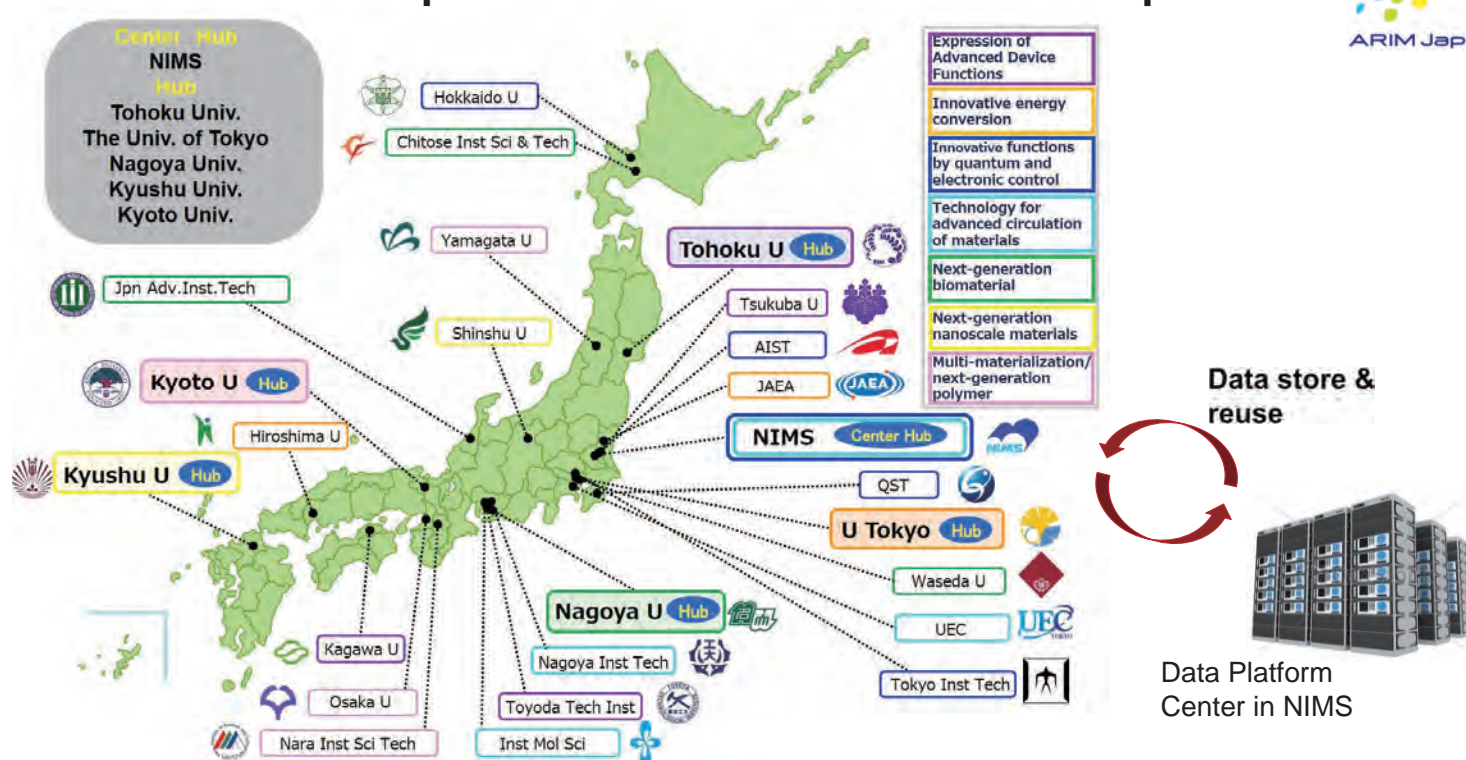


NINS: National Institutes of Natural Sciences
IMS: Institute for Molecular Science
QST: National Institutes for Quantum Science and Technology
AIST: The National Institute of Advanced Industrial Science and Technology
JAEA: Japan Atomic Energy Agency

NAIST: Nara Institute of Science and Technology
JAIST: Japan Advanced Institute of Science and Technology
UEC: The University of Electro-Communications

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Hubs and Spokes Network Distributed over Japan



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ICONS for Seven Key Technology Areas (Advertisement strategy to promote ARIM)



Materials with advanced device function



Innovative energy conversion materials



Quantum & electronic functional materials



Technology for advanced circulation of materials



Next-generation bio-materials



Nano-scaled materials



Next-generation polymers & multi-materials



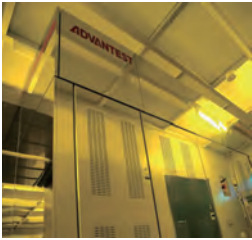
10



Top recommended equipment



HUB



- The Univ. Tokyo:
- Ultrarapid Electron Beam Direct Writing and Photo Mask Fabrication Machine

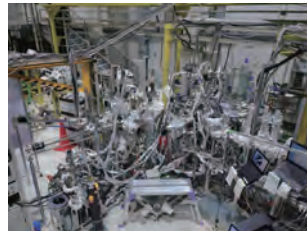


SPOKE

- Hiroshima Univ:
- Ion implanter



- Low-voltage atomic-resolution Scanning Transmission Electron Microscopy



SPOKE

- JAEA:
- Surface chemistry experimental apparatus



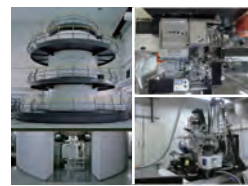
Top recommended equipment



HUB



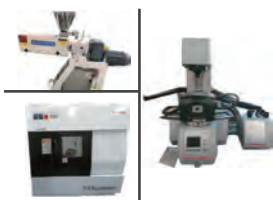
- Kyoto Univ.:
- High Speed Maskless Laser Lithography
 - High Pressure Jet Lift-off System
 - Monochromated atomic resolution analytical electron microscope



SPOKE

- Osaka Univ.:
- 3MV Ultra-High Voltage Electron Microscope
 - Automatic pulsed laser deposition nano-materials synthesis system
 - High definition focused ion beam system

SPOKE



- Yamagata Univ.:
- Co-extrusion system
 - Twin-drive rotational rheometer
 - Micro-focus X-ray CT scanner

SPOKE



- NAIST:
- 3MV Ultra-High Voltage Electron Microscope
 - Automatic pulsed laser deposition nano-materials synthesis system
 - High definition focused ion beam system



Top recommended equipment



HUB

Kyushu Univ.:

- 30-200 kV Atomic resolution analytical electron microscope
- Analytical plasma FIB-SEM



- Scanning electron microscope system

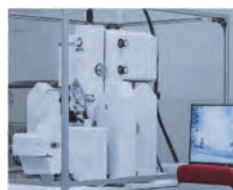


- Scanning electron microscope system

SPOKE

Shinsyu Univ.:

- Remote-controlled electron probe microanalyzer



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Top recommended equipment



HUB

Tohoku Univ.:

- i-line stepper
- Flagship Transmission Electron Microscope



SPOKE

Toyoda Tech. Inst.:

- Stylus profilometer
- Oxidation/diffusion furnaces for Si



SPOKE

Kagawa Univ.:

- Dual ion beam sputtering system
- White light interference type non-contact three-dimensional shape measuring system



SPOKE

Tsukuba Univ.:

- Power Device Electrical Measurement System
- IR Emission Microscope
- Cryogenic Probe station



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Top recommended equipment



HUB



NIMS:

- Analytical apparatus for electron beam sensitive materials

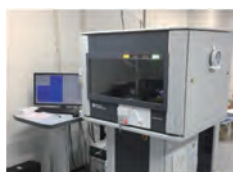


SPOKE

UEC:

- Magnetic Property Measurement System
- Physical Property Measurement System

SPOKE



NINS-IMS:

- Molecular structure analysis using the crystalline sponge method



SPOKE

Nagoya Inst. Tech.:

- Mössbauer Spectrometer

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Top recommended equipment



HUB



Nagoya Univ.:

- X-ray CT · fluorescence double modal in vivo imaging system
- Reaction science high-voltage scanning transmission electron microscope
- Electron beam lithography



SPOKE

JAIST:

- Liquid chromatography-mass spectrometry

SPOKE



Waseda Univ.:

- Glow discharge optical emission spectrometry



SPOKE

Chitose Inst. Sci. Tech.:

- Raman imaging microscope

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Top recommended equipment



HUB

NIMS:

- Atomic Layer Etching System



SPOKE

Hokkaido Univ.:

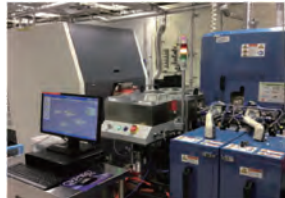
- Ultra-high precision electron-beam lithography system



SPOKE

Tokyo Inst. Tech.:

- Maskless Lithography System



SPOKE

AIST:

- X-ray Photoelectron Spectroscopy Analysis System



SPOKE

QST:

- Synchrotron radiation Mössbauer spectrometer

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Other equipment can be searched on the ARIM web site

<https://nanonet.mext.go.jp/facility.php>

ARIM Service Description



Technical Consultation

The technical staff of each hub & spoke institution responds to user's various requirements to solve technical issues.



Equipment Operation by users

Equipment is operated by the users themselves. Data analysis is also carried out by the user.



Technical Assistant

Users operate the equipment with the assistance of technical staff of ARIM



Operation on behalf of users

Based on the request, the technical staff of ARIM conducts experiments, measurements, and analyses



Research Collaboration

Users and hub-spoke institutions of ARIM will collaborate on experiments, data analysis and academic discussions



Data Utilization

The accumulated data can be used as a database and can also be utilized to derive new information for users

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Trial use



To promote the use of ARIM services, ARIM provides a trial use for customers.

Type of use



Technical Assistant

Equipment Operation by users

Operation on behalf of users

Target user

- First time user
- Researcher under 40 who belongs to Univ. or research institute
- User belongs to startup or SME

Fee

ARIM will pay usage fee up to ¥150,000

Another condition

User needs to agree with data registration



Trial use

Apply (submit from facility)

Screened by coordinators

Screened by representatives

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Events to improve the skills of the technical staffs



Training program

Purpose:

- Improve the skills of and build a network among technical staffs
- Broaden the technical staffs' knowledge through lectures, practical training, and discussions by the host facility staffs

How:

- 25 facilities are asked to propose training programs
- Technical staffs choose 1 or 2 programs and visit host facility for 1 to 5 days

After the program:

- Both participant and host facility staff are needed to submit the report

Results of 2022FY

- 25 facilities proposed 44 programs
- 53 technical staffs participated in 39 programs

Workshop

Purpose:

- By gathering in one place to share and exchange information on each other's facilities, improvement of their skills and form human networks

How:

- Two days event including poster session by the technical staffs from 25 facilities, an invited talk and a lab. tour

Results of 2022FY

- 79 participants including 44 technical staffs
- Professor Hitosugi of the Univ. of Tokyo gave the invited talk

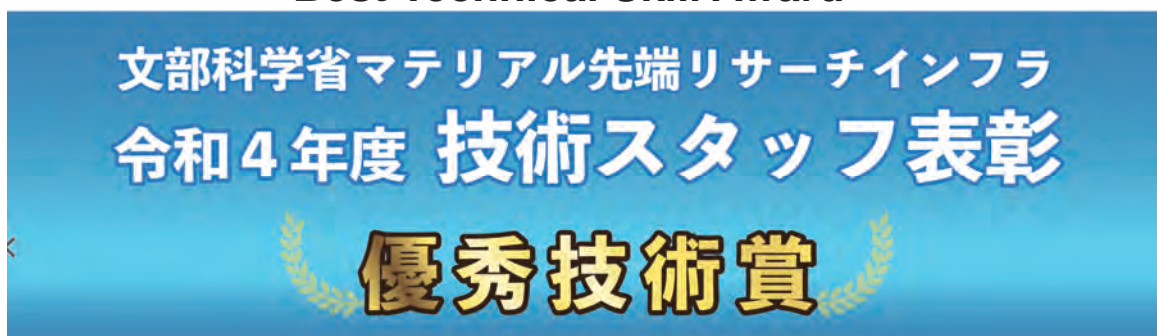


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Awards for technical staffs



Best Technical Skill Award



Title: Scrutiny about TEM data
Winner: Fumihiko Uesugi (NIMS)

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Awards for technical staffs

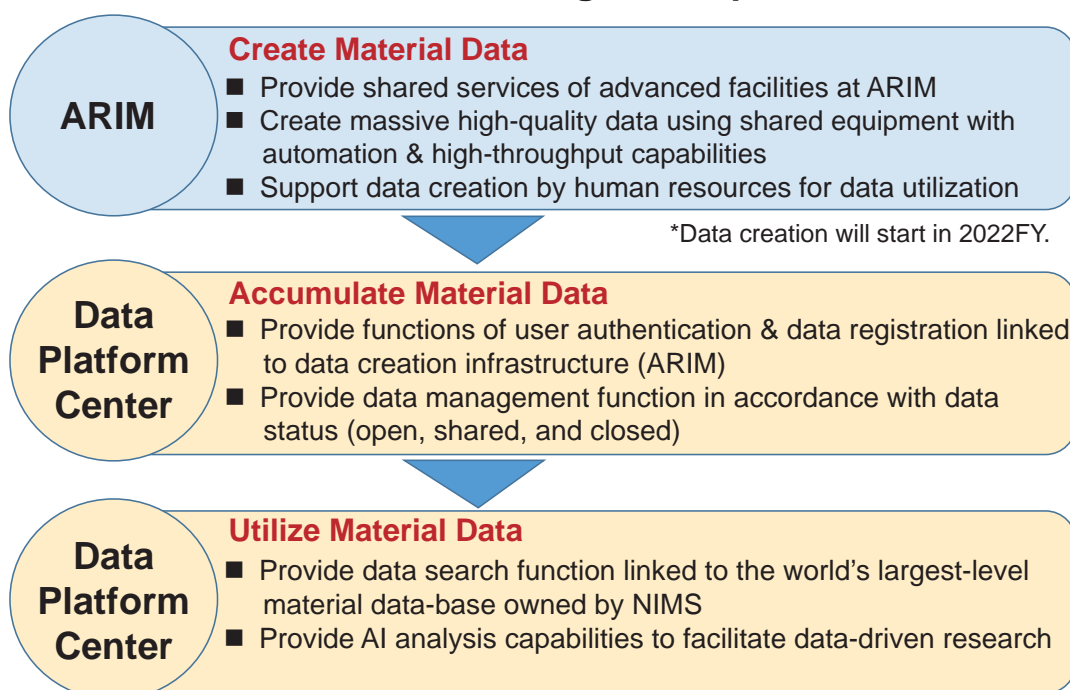
Best Technical Support Contribution Award



- Title:** Technical support for Advanced Characterization and efforts to improve our work efficiency
Winner: Naomi Hirai (Hokkaido Univ.)
- Title:** Technical support for high resolution analysis of elemental and isotopic distribution using NanoSIMS
Winner : Miyuki Takeuchi (The Univ. of Tokyo)
- Title:** Technical support for advanced characterization of materials by Transmission Electron Microscopy
Winner : Tsutomu Kiyomura (Kyoto Univ.)
- Title:** Technical support for Material Structure Analysis and Research based on NMR
Winner : Fumio Asanoma (Nara Inst. Sci. Tech.)

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Data Collection from Advanced Shared Facilities and Data Utilization throughout Japan

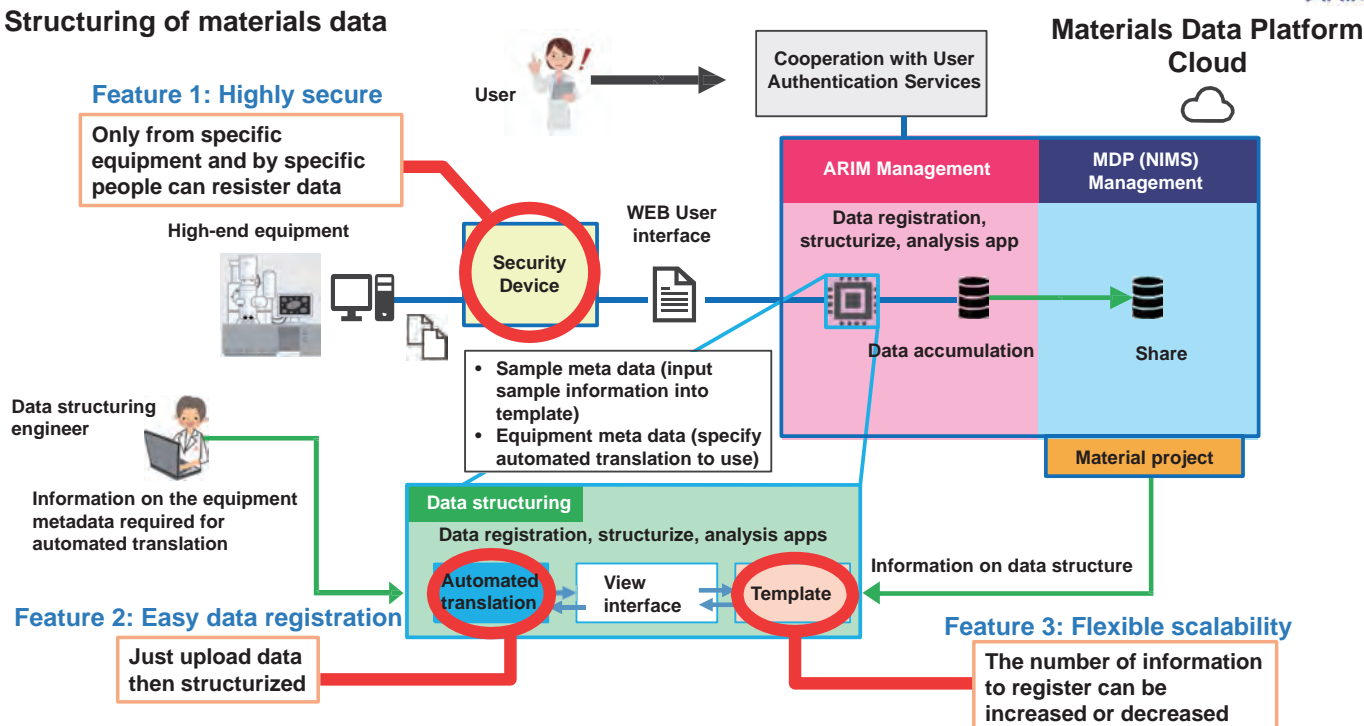


*Data utilization service will start in 2024FY.

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Structuring and utilization of materials data

Structuring of materials data



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Summary

- Japanese government strategy to enhance materials innovation capacity was formulated in 2020, and “AI”, “Bio”, “Quantum”, and “Environment” fields were selected as a priority strategy. One of the important action plans is to develop the “materials DX platform”.
- The concept of the materials DX platform cooperation was shown as formation of the triangular cooperation scheme, which consisted of (1) Material Data Platform at NIMS, (2) ARIM, and (3) DxMT.
- **ARIM** was launched in 2021 which consists of 25 universities & national labs.
- Create icons for promotion, training program, workshop as well as award giving ceremony are proceeded to promote use of ARIM and improve the skills and enhance the motivation of technical staffs.
- The scheme for data creation from advanced shared facilities of ARIM and data utilization at the NIMS data platform center for researchers throughout Japan is established.

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Nanotechnology Hub in Kyoto University Facility and Material Data Network Hub for Next-Generation Polymers & Multi-Materials

Toshiyuki Tsuchiya

Director, Nanotechnology Hub

Professor, Department of Micro Engineering,
Kyoto University, JAPAN



京都大学
KYOTO UNIVERSITY



Contents

- Nanotechnology Hub in Kyoto University
- Next-generation polymers & multi-materials
 - Hub and spork collaboration
 - Examples
- DX in Nanotechnology Hub
 - Process registration tool
 - High-throughput data correction and upload





Nanotechnology Hub at Kyoto University



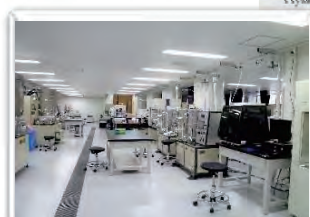
Feb 2, 2023

3



京大ナノハブの施設 Facilities (Yoshida Main Campus)

Room No.	Floor area (m ²)	Class
Yellow room	177.6	100
Clean room 1	110.1	1,000
Clean room 2	53.8	1,000
Control room	34.7	NA



加工・評価室1
Fab. & Eva.
Room 1

	Floor area (m ²)	Class
Fabrication & evaluation room	180	100,000
Clean room	147	100, 1,000

クリーンルーム
Clean Room



加工・評価室2
Fab. & Eva.
Room 2

	Floor area (m ²)
F & E room 2	150

事務室
Office

Office	Floor area (m ²)
Satellite office for users	34
KU nanohub admin	50



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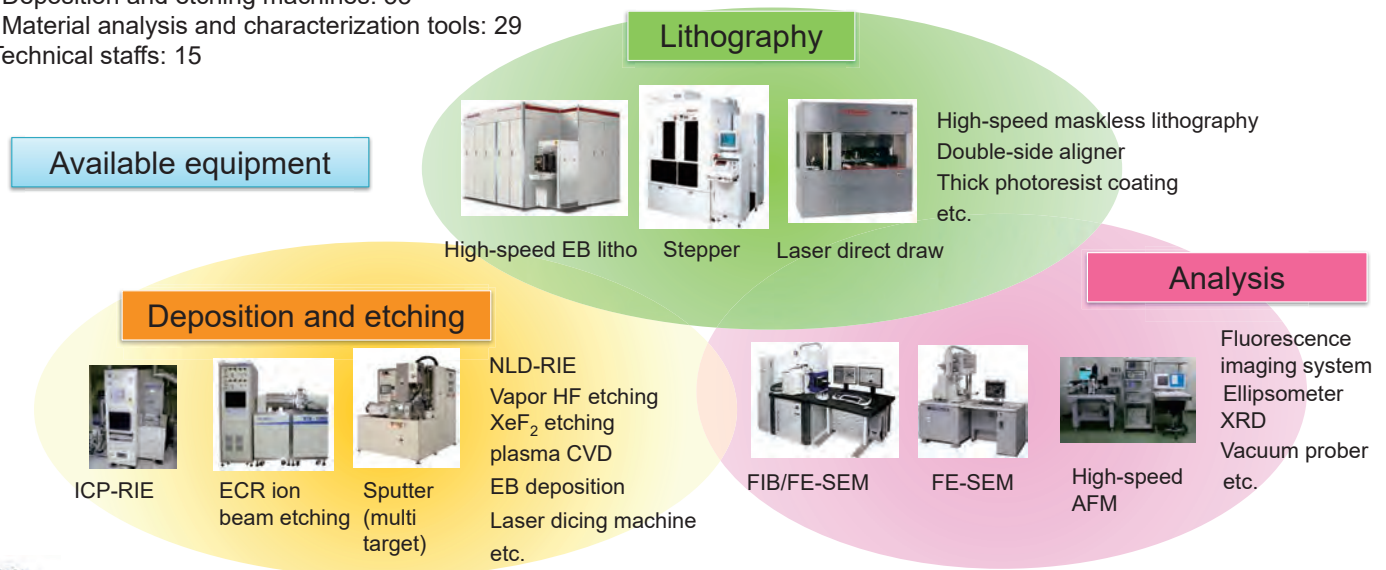
4



Cleanroom Facilities for Nano-fabrication

More than 80 equipment are available for all users in academia and industry.

- Lithography process machines: 19
 - Deposition and etching machines: 33
 - Material analysis and characterization tools: 29
- Technical staffs: 15

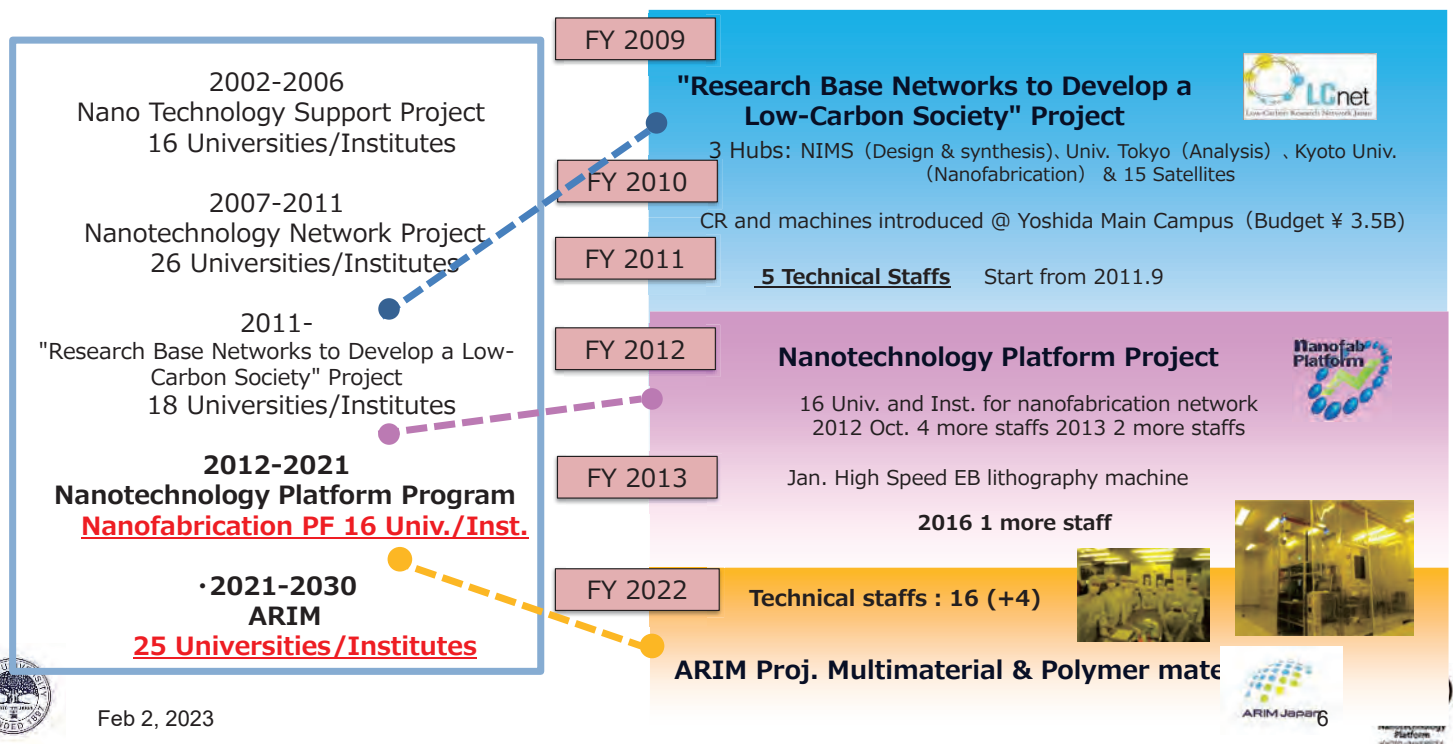


Feb 2, 2023

5



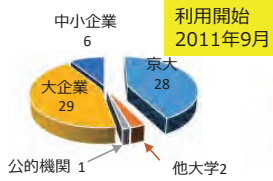
Nanotech facility network in Kyoto University



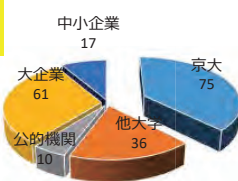
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Research projects by affiliation

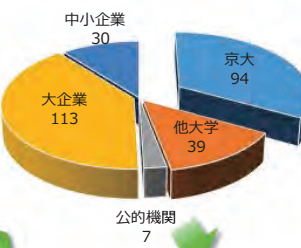
2011:66



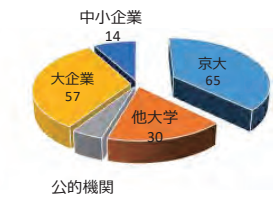
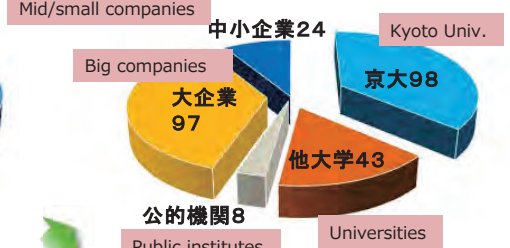
2015:199



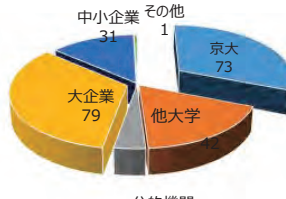
2019:283



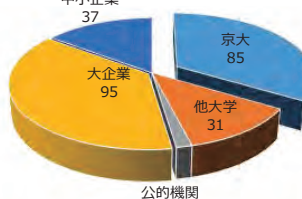
2021:270



2013:173



2017:235



2020:252

Machine usage / FY2022
(Kyoto U) 4,989
(Academia) 1,668
(Industries) 7,560件
件数=利用人数×台数×日数



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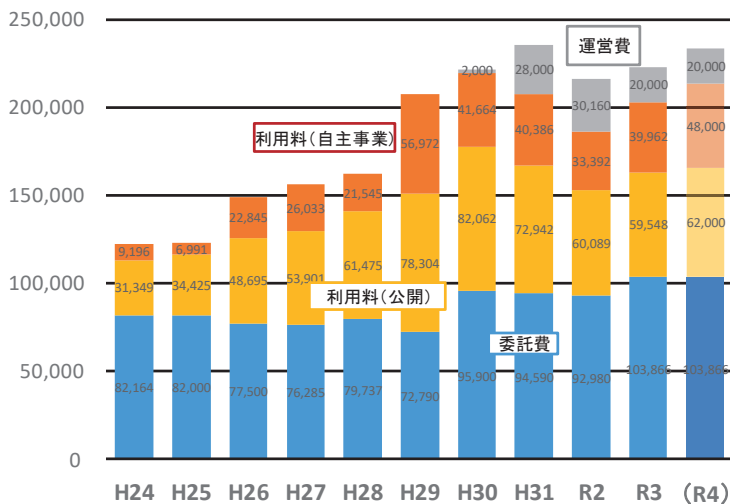


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Budgets

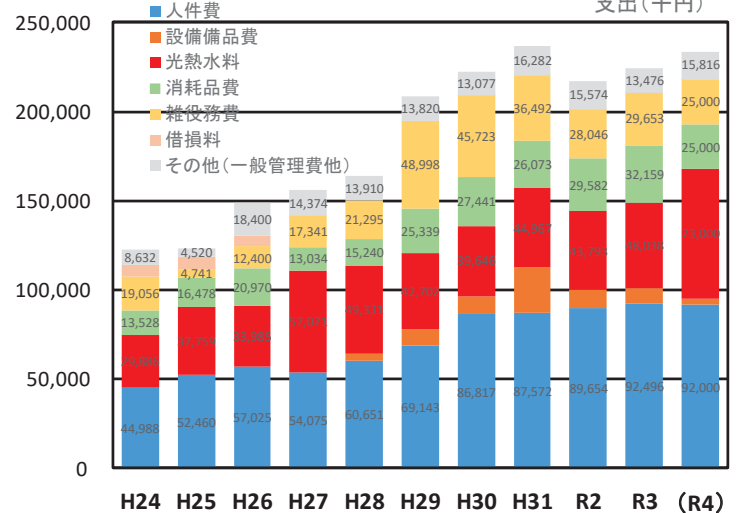
Income

収入(千円)



Expenses

支出(千円)



Feb 2, 2023



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Training for beginners

Device fabrication training (2-4 days course)

バイオ&ナノマイクロデバイス実践セミナー
～最先端加工技術のバイオ分野への応用に向けて～

最先端加工技術を利用して医療や分析チップなどを作製してみたいと考えるバイオ系研究者(医、薬、農、理など)やバイオ分野への研究に参画したいと考える工学系研究者(電機、機械などの分野のPhD・大学院生)のみなさまへ
講義・実習を行い、プロトタイプとしての利用を目的としたバイオ系最先端加工技術の理解・習得を目的とします。
参加の多い分野の希望の参加人数を定めます。

セミナーは、講義コースと実習コースがあり、実習コースは講義コース受講が条件となります。
(実習コースのみの受講は出来ません)

・参加費:無料(実習コースの一部は有料)
・定員:40人(東京大学本会場)・TV会場
※TV会場の定員については事務局までお問い合わせください。

<http://nankyoto-uao.jp/p/bio-nanomicrodevice.html>

【実習コース】

平成30年10月12日(金) 18:00～17:00

本会場:東京大学 浅野キャンパス 武田先端ビル1F セミナー室
TV会場:北海道大学、東北大学、富田工業大学、京都大学、大阪大学、山口大学
※TV会場ではWAVEXを利用し、東京大学本会場のセミナーをTV中継します。

時間	講演題目	講演者
13:00～13:05	開会挨拶	事務局(江村 代表)
13:05～14:05	講演1:「バイオ分野におけるMEMSチップの特性と応用」	藤田 博之(代表講演)
(10分休憩)		
14:15～14:45	講演2:「バイオ分野におけるMEMSチップの応用」	藤田 博之(代表講演)
14:45～15:15	講演3:「バイオ分野におけるMEMSチップの応用」	藤田 博之(代表講演)
15:15～15:45	講演4:「バイオ分野におけるMEMSチップの応用」	藤田 博之(代表講演)
15:45～16:15	講演5:「バイオ分野におけるMEMSチップの応用」	藤田 博之(代表講演)
16:15～16:45	講演6:「バイオ分野におけるMEMSチップの応用」	藤田 博之(代表講演)
16:45～17:00	講演7:「バイオ分野におけるMEMSチップの応用」	藤田 博之(代表講演)

FY2020
Lecture: 5 courses
Practice : 5 courses

Online lecture

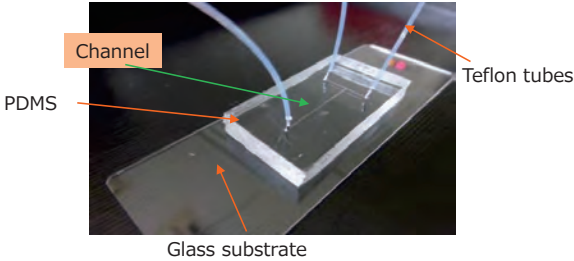


Practice of PDMS microfluidic device fabrication

2 – 3 times/year, for students, researchers
Maskless lithography



Fabricated device



Feb 2, 2023

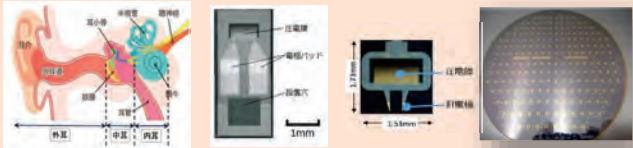


9

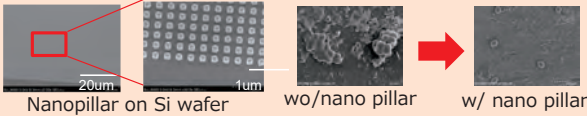
Examples of life science research support

Novel hearing device (Kyocera, Kyoto Univ., Shiga Pref. Medical College)

Novel cochlear implant without battery



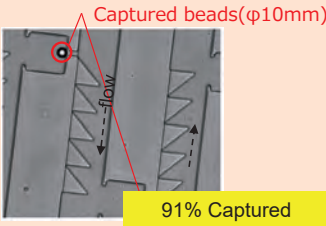
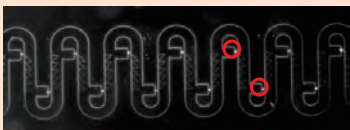
Nanostructure for bile duct stent (Ritsumeikan Univ.)



Avoid contamination in bile duct stent by nanostructures

Microstructure for cell capture (Sysmex)

Microchannel device captures a small amount of cells in a designated position.

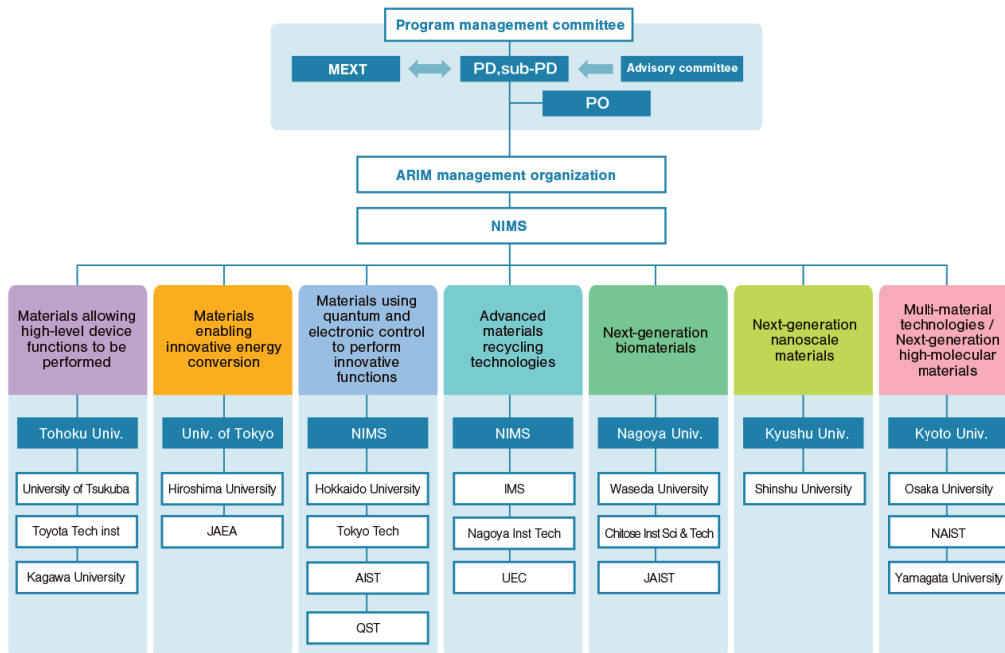


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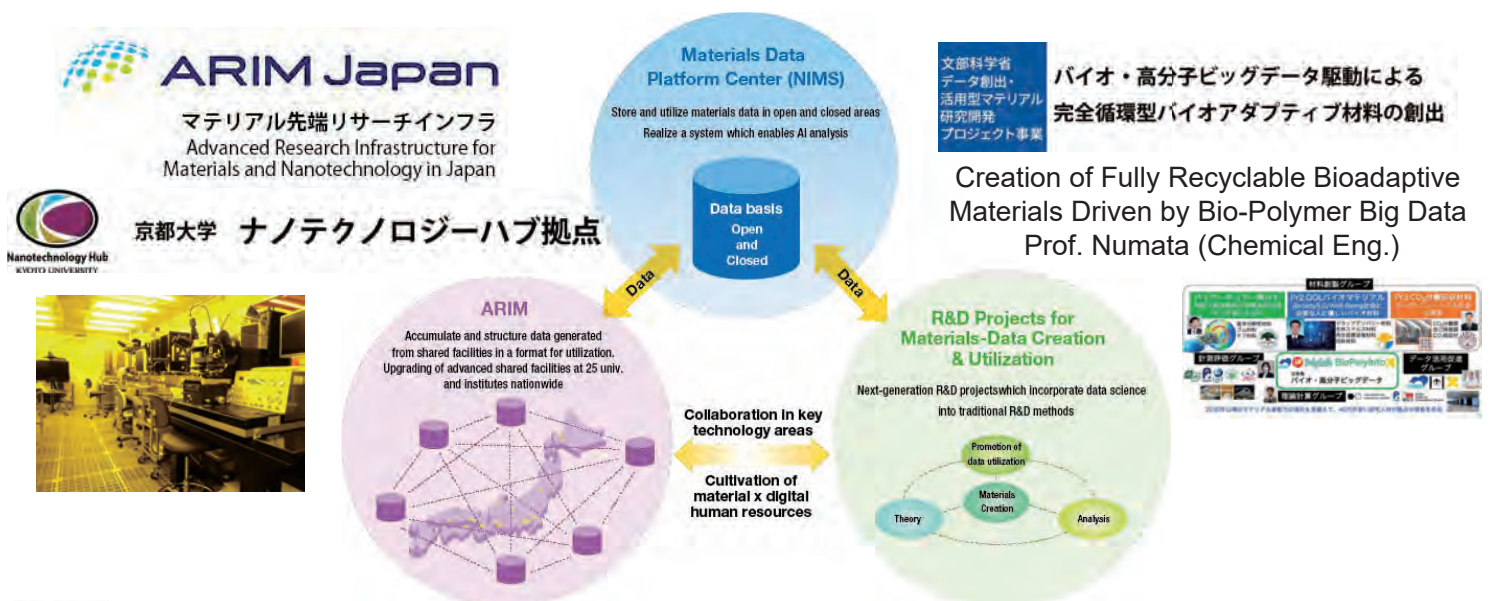
ARIM Project Organization



Feb 2, 2023

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Material DX Platform @ Kyoto University



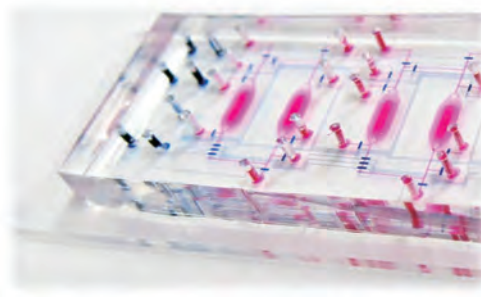
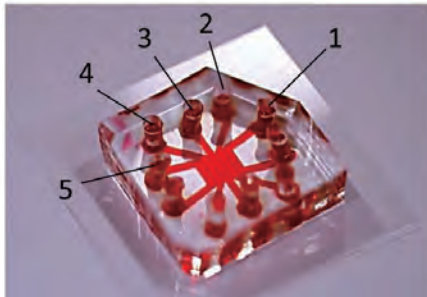
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Target: Polymer and Multi-Material

- Contribute to data-driven R&D for the polymers & multi-materials with unique properties, such as high-strength, biocompatibility, and self-healing with the aim of integrated chemical analysis & bio-functional chips

Micro Physiological System

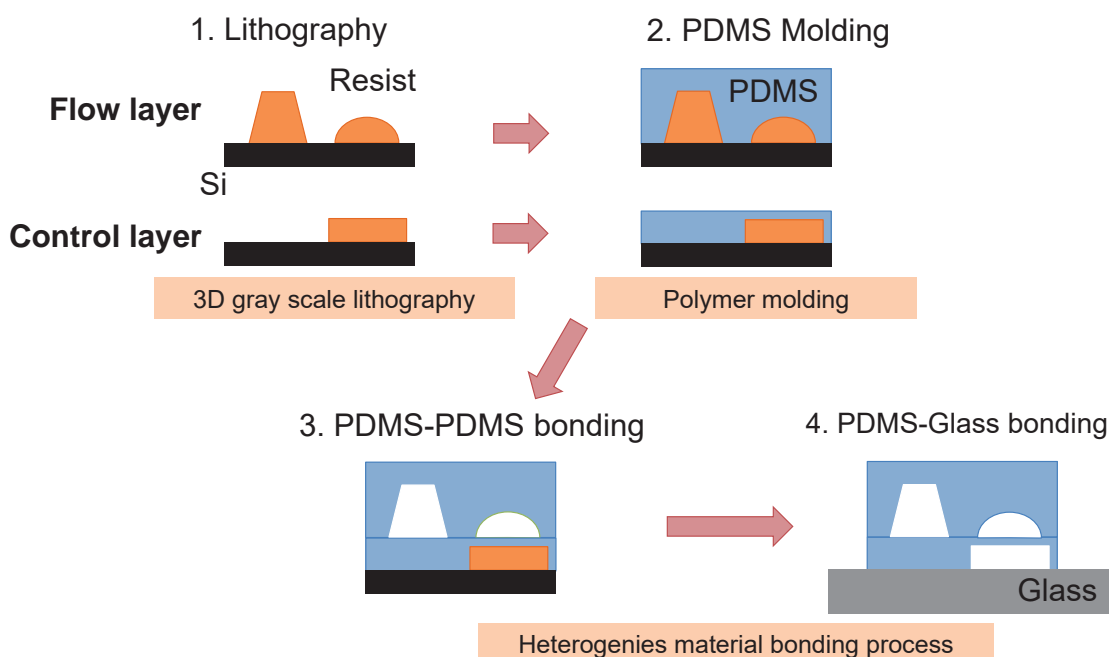


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PDMS microfluidic device

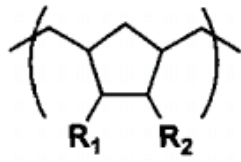


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COP (Cyclo-Olefin Polymer)



Available from Zeon Corp.

- Optical components (lens, diffraction grating)
- Pharmaceutical packages (Blood analysis container, blood transfusion bag)

Advantages

- Precision molding possible, **excellent formability**
- **Stable, no elution of impurities**
- **Gas barrier**
- **Good acid, Alkali, and alcohol resistance**
- Low hygroscopicity

Grade	Glass transition Temp. Tg
ZEONEX 690R	136°C
ZEONOR 1060R	100°C

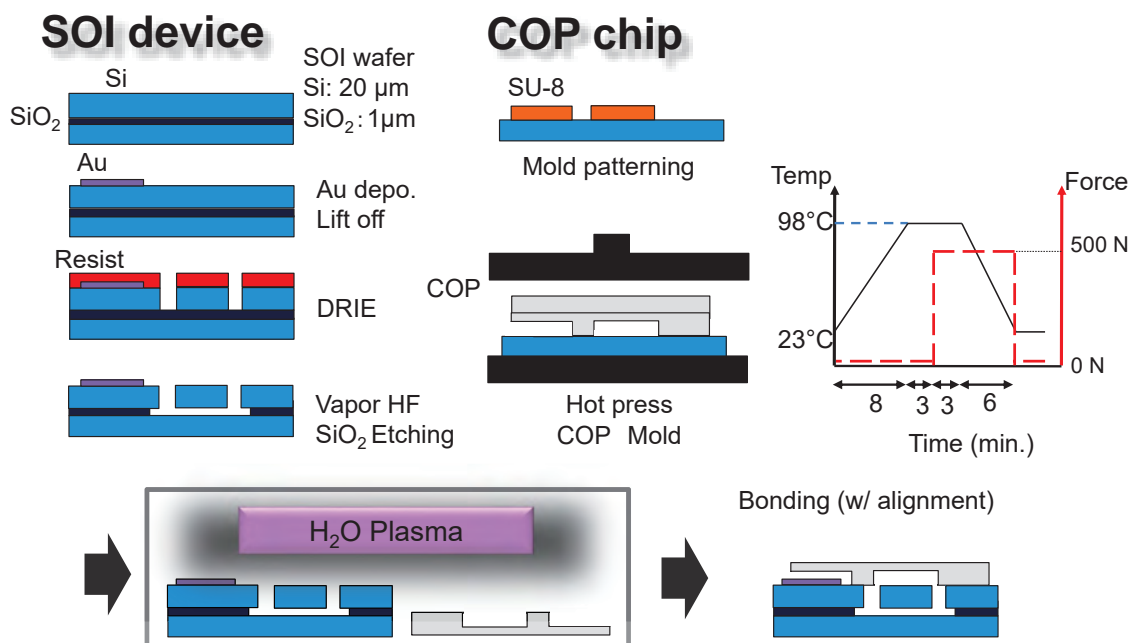


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Low temperature bonding process



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DX @ Nanohub for material and process infomatics

- Create massive high-quality data using shared equipment with automation & high-throughput capabilities
 - Introduce a new machine for data collection (Wafer profiler)
- Database for microfabrication process recipe and flow
 - Process flow registration integrated on machine reservation system
 - Collaboration with other universities and institute
- Database creation for “Standard process”
 - Microfluidic device: (polymer materials)
 - 3D grayscale lithography database for mold fabrication process
 - Wafer profiler
 - SOI MEMS sensor (multi-materials)
 - Piezoelectric MEMS device

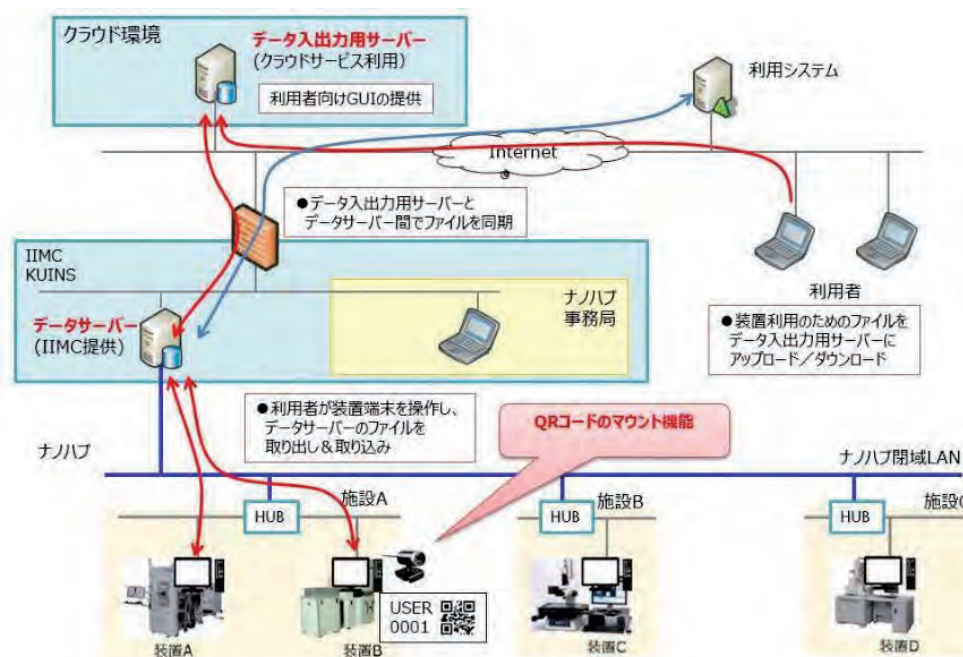


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Servers and networks for data collection and utilization



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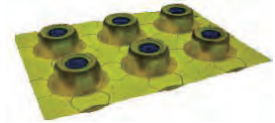
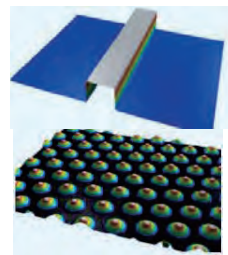
21

Wafer profiler (FY2020)

- High volume and high speed processing of wafer-level profile measurement for lithography, deposition, etching...
- Start of operation (shared use from July)
- Automatic data registration scripts is being developed.

Featured specification

- (1) Multi confocal microscope system
- (2) Supports various types of measurement (step, roughness, 2D/3D display)
- (3) Compatible with a wide variety of materials
- (4) Data communication function
- (5) Automatic wafer transfer system



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Database for nanofabrication

Two data types

1. Process flow data

- Data on the flow of a series of steps to fabricate a device or sample
- A set of process steps
- Has a hierarchical structure
- Users are requested to input at the time of application of project
- Conditions

2. Process machine data

- Data on the relationship between processing conditions and results at each process step
- Processing conditions
- Results: dimensional, electrical, and mechanical
- Staff collects
- Automated equipment in consideration of usage conditions, user needs, etc.



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Structure of “nanofabrication process” database



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Process flow tool

- Registered process flows

京都大学ナノテクノロジーハブ拠点
設備利用管理システム

総合管理 総合管理 さん

マイページ
アカウント
課題申請
Process Flow
Process Manager
装置
消耗品
安全教育・装置講習
装置予約
利用履歴 (予約) 検索
消耗品発注検索
装置予約状況
予約申込み一覧
予約キャンセル一覧
利用確認
メンテナンス記録
課題利用料金
装置稼働日数
課題利用日数
利用報告
外部発表登録
各種ダウンロード
お知らせ
カウンタ

Process Flow List

ThemeID	Process Flow Name	Updated		Data Share	
		UserID/Name	Date & Time	User	Library
<input type="checkbox"/> H22002	A/電極/パターン (リフトオフ)	[1] 総合管理者	2023/01/30 20:04	NG	Waiting
<input type="checkbox"/> H22002	PCMS型マイクロバブル/ポンプ	[8] 高橋 英樹	2023/01/30 20:05	OK	Accept
<input type="checkbox"/> H22002	TEST	[3] 情報技術 新開	2023/01/30 20:08	NG	----
<input type="checkbox"/> H22002	電極形成2	[8] 高橋 英樹	2023/01/30 20:09	OK	Accept
<input type="checkbox"/> H22002	静電容量型加速度センサ(1)	[1] 総合管理者	2023/01/30 19:40	OK	Accept
<input type="checkbox"/> Z22123	フォトリソ: TMAH-IP1600	[1] 総合管理者	2023/01/30 20:09	OK	Accept
<input type="checkbox"/> H22002	静電容量型加速度センサ(2)	[1] 総合管理者	2023/01/30 20:10	OK	Accept
<input type="checkbox"/> E22001	GS用フォトマスク(1)	[1] 総合管理者	2023/01/30 20:10	OK	Accept
<input type="checkbox"/> E22001	GS用フォトマスク(1)	[1] 総合管理者	2023/01/30 19:50	NG	----

1 PAGE TOP

Process Flow Assist Tool

Process Flow Assist Tool - Detail << Back to Process Flow List >>

ThemeID: グレースケールレーザ露光条件調整 Updated UserID/Name: [8] 高橋 英雄 Data Share: OK
Process Flow Name: 静電容量増減度センサ Updated Date & Time: 2023/01/30 18:14 Library Reg: Accept

Process Step Insert Step Edit Step Step Up Step Down Duplicate Step Delete Step Save Save As

No.	Category	Apparatus	Method	Recipe Name	CODE
20	熱処理	ホットプレート (三連タイプ) TH-900	Prebake	Prebake(90°C/90s)	236
21	リソグラフィ	露光マスクアライナー	UV Exposure(THMR-#1800)	THMR-#1800_0.95um	237
22	熱処理	ホットプレート (三連タイプ) TH-900	PEB(THMR-#1800)	PEB_1100C/90s	238
23	リソグラフィ	レジスト塗布装置	Develop(THMR-#1800)	SP develop	239
24	加工・エッチング	深層リドライエッチング装置 60"仕様 [E808-1]	Si Etch	REC12(1)	240
25	加工・エッチング	深層リドライエッチング装置 60"仕様 [E808-1]	Si Etch	REC12(2)	241
26	表面処理・洗浄	有機溶剤ドラフト	NOVEC7100	CF CLEAN	242
27	表面処理・洗浄	有機溶剤ドラフト	ST120	Resist-strip	243
28	表面処理・洗浄	ドライエッチング装置	Resist-strip	O2 Aitch.	244

Recipe Details Save

CODE	Recipe Name	Apparatus No.	Recipe No.	ETC (Y)	Hot Press (MPa)	Gap (mm)	Loop1 Start step	Loop1 End step	Loop2 Start step	Loop2 End step
241	REC12(2)	835	12	1200	2	30	3	8	120	

STEP RECIPE	STEP1	STEP2	STEP3	STEP4	STEP5	STEP6	STEP7	STEP8	STEP9	STEP10	STEP11	STEP12
SPM [sec]			0	100	100	100	100	100	100	100	100	100
CAP [sec]			100	100	0	0	0	100				
O2 [sec]			0	0	0	0	0	0	0	0	0	0
Ar [sec]			0	0	0	0	0	0	0	0	0	0
APC-Pos./Press.			Pos.	Pos.	Pos.	Pos.	Pos.	Pos.	Pos.	Pos.	Pos.	Pos.
APC-Pos./Press. Value [N/μm]			100	100	100	100	100	100	100	100	100	100
ICP(13.56MHz) [W]			1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Bias(13.56MHz) [W]			0	0	0	0	0	0	0	0	0	0
Bias(13.56MHz) Phase			OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Bias(400kHz) [W]			0	0	1	70	0	0	0	0	0	0
Bias(400kHz) Phase			OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
Time [sec]			0.5	0.5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Copy To												

Process Library

Process Library

Process Flow Assist Tool - Step Import << Back to Process Flow List >>

ThemeID: 圧力センサーの作製 Updated UserID/Name: [1] 総合管理室 Data Share: NG
Process Flow Name: ひずみゲージ型圧力センサー(1) Updated Date & Time: 2023/01/30 20:34 Library Reg: Accept

Process Step Insert Step Edit Step Step Up Step Down Duplicate Step Delete Step Save Save As

No.	Category	Apparatus	Method	Recipe Name	CODE
0	基板	基板	Mask Fab.	5" Mask Blanks (Photomask)	300
1	リソグラフィ	レーザー露光装置	Mask Fab.	Exposure (Photomask)	301
2	リソグラフィ	レジスト塗布装置	Mask Fab.	MASKd50SEC (Photomask)	302
3	加工・エッチング	有機溶剤ドラフト	Mask Fab.	CF Etch (Photomask)	303
4	表面処理・洗浄	有機溶剤ドラフト	Mask Fab.	PR Remove/Acetone (Photomask)	304
5	表面処理・洗浄	フエンスピン洗浄装置	Mask Fab.	SPM Cleaning (Photomask)	305

Step Import Close

Process Library

Process Group	Primary	Secondary	Initially	Process Flow Name
フォトマスク作製フロー	フォトマスク (高橋)			フォトマスク (1)

ThemeID: GS用フォトマスクの作製 Updated UserID/Name: [1] 総合管理室 Data Share: OK
Process Flow Name: GS用フォトマスク(1) Updated Date & Time: 2023/01/30 20:31 Library Reg: Accept

Process Step

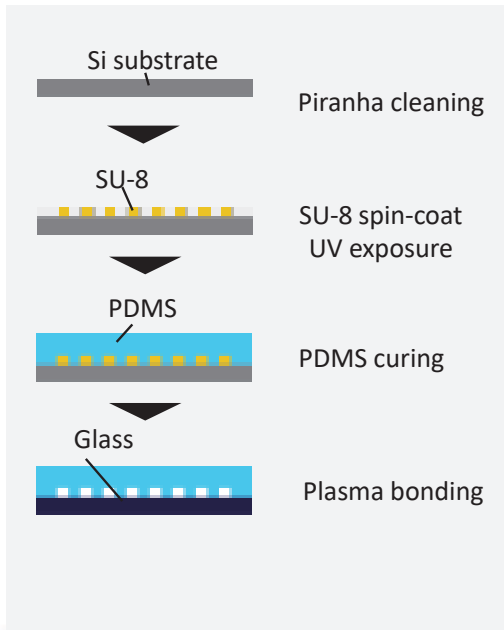
No.	Category	Apparatus	Method	Recipe Name	CODE
0	基板	基板	Mask Fab.	5" Mask Blanks (Photomask)	288
1	リソグラフィ	レーザー露光装置	Mask Fab.	Exposure (Photomask)	289
2	リソグラフィ	レジスト塗布装置	Mask Fab.	MASKd50SEC (Photomask)	290
3	加工・エッチング	有機溶剤ドラフト	Mask Fab.	CF Etch (Photomask)	291
4	表面処理・洗浄	有機溶剤ドラフト	Mask Fab.	PR Remove/Acetone (Photomask)	292
5	表面処理・洗浄	フエンスピン洗浄装置	Mask Fab.	SPM Cleaning (Photomask)	293

Recipe Details

CODE	Recipe Name	Apparatus No.	SPM temperature [°C]
293	SPM Cleaning (Photomask)	A11	50

STEP RECIPE	STEP1	STEP2	STEP3	STEP4	STEP5	STEP6	STEP7
Process	SPM	Hot DE	Bubbjet	Negative	Hot DE	DE	Dry
Time [sec]	20	90	30	30	0	20	90

Standard process database : Ex. Microfluidic device



Mold fabrication

- Thick film photoresist
- Silicon DRIE (mold)
- Machining
- 3D printing (mold, direct)

Molding process

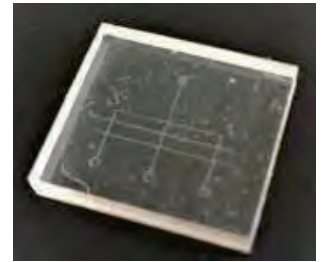
- PDMS molding
- polymer COP

Bonding to glass substrate

- UV, Surface activation, glue
- Resin mold
- Multilayer

Tubing

- Punching
- Flow generation

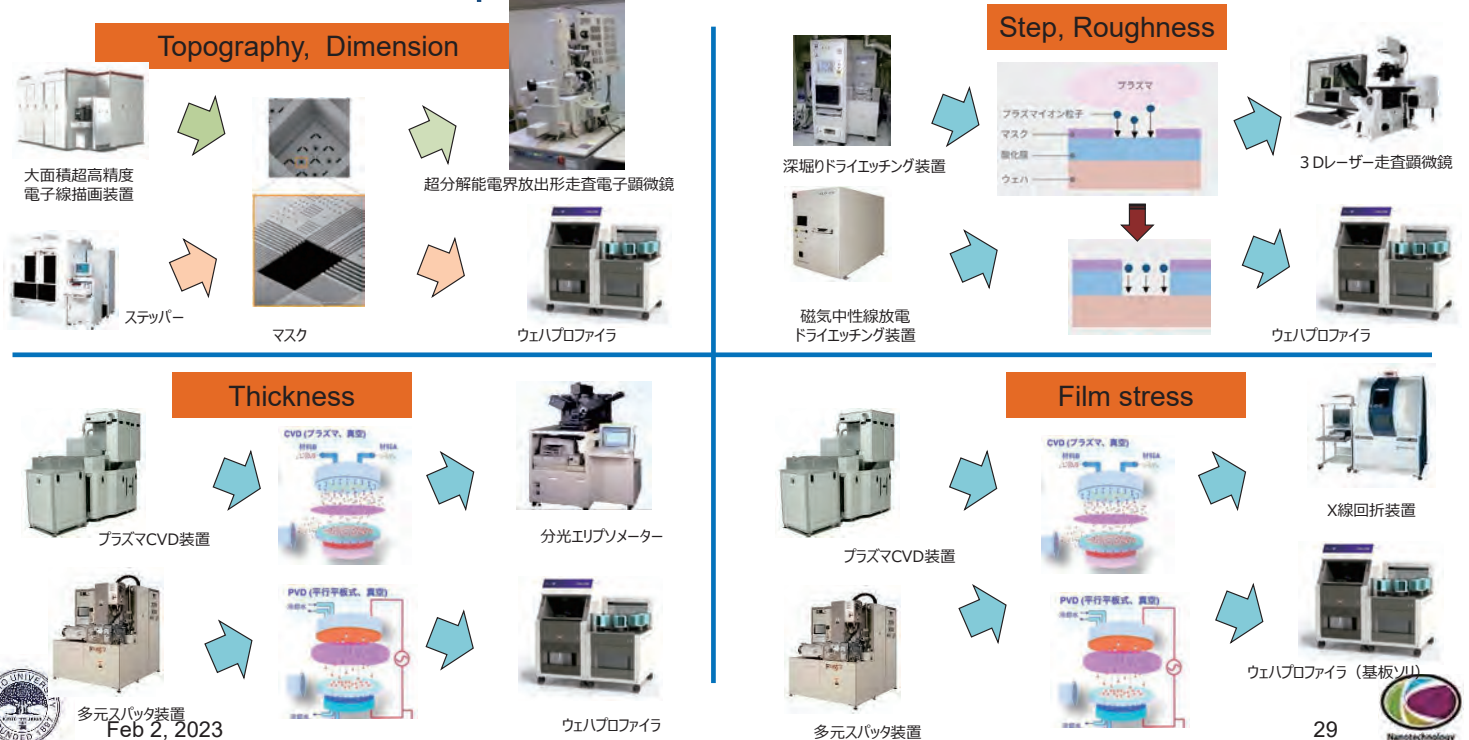


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Example of process machine data



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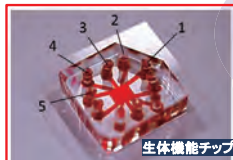
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Advanced research infrastructure for materials and nanotechnology (ARIM)

Collection and utilization of high-quality material process data produced by shared use of advanced research facilities

Support data-driven materials research in the field of polymeric materials and combinations and composites of a wide variety of materials



京都大学
KYOTO UNIVERSITY
ナノテクノロジーハブ拠点

データ構造化
データ蓄積、利活用

高分子 マルチマテリアル

プロセスデータ

スタッフの支援

装置を持たずに
アイデアを実現

自分で、素早く
安価に製作

利用者

機器利用
技術相談
技術代行

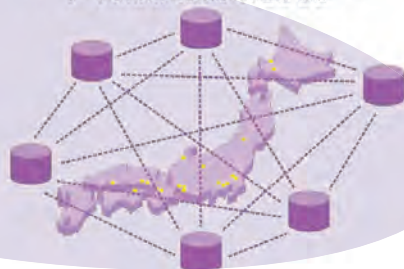
微細加工

構造解析

80を超える高度な研究設備の共用

ARIM Japan

全国25の大学・研究機関の先端共用設備を整備・高度化するとともに、共用設備から創出されたデータを利活用可能な形式で蓄積・提供



材料・プロセスデータベースのユーザーとデータ利活用



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Asia Nano Forum

UFN-WG

2023 Symposium on User-Facility Network in Asia



UNIVERSITI
MALAYA



Professor Dr Mohd Rafie Bin Johan

Universiti Malaya,

Malaysia

NANOCAT: It's
Functional,
Achievement and
Contribution
Towards R&D
Nanotechnology
Facilities,
Scientific
Communities
and Nation



NANOCAT

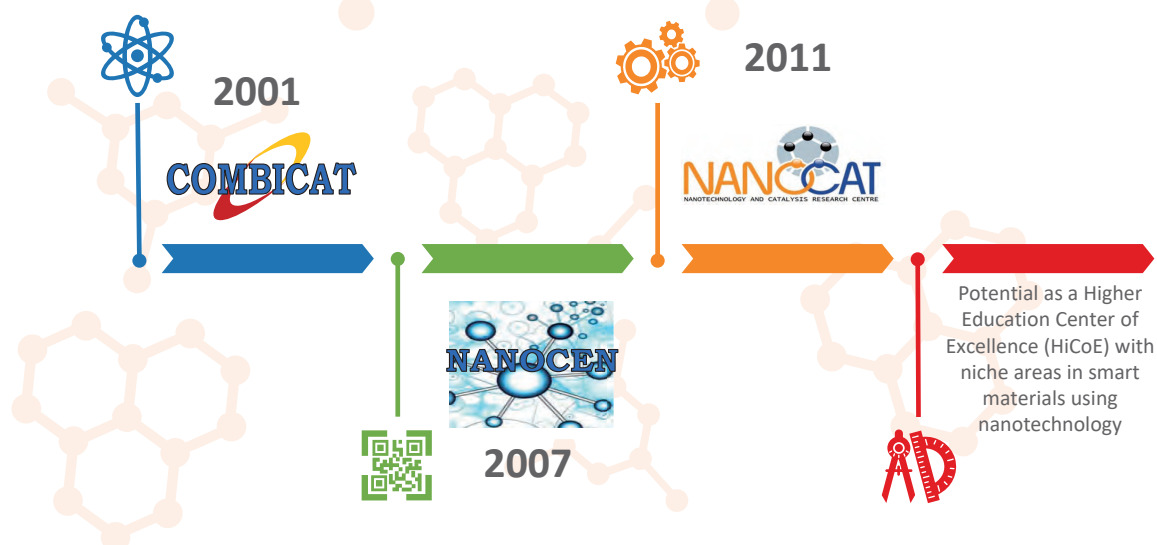
OVERVIEW

JANUARY 2023

OVERVIEW



OUR JOURNEY



2



VISION & MISSION

VISION

To be an internationally renowned and recognised
CoE in Catalysis and Nanomaterials

MISSION

To advance technological excellence in
multidisciplinary research to address the key
challenges of 21st century

3



MANAGEMENT



PROF. DR. MOHD RAFIE JOHAN

Director of Nanotechnology & Catalysis Research Centre (NANOCAT)

Mohd Rafie Johan was a Professor of Materials Engineering in Department of Mechanical Engineering, University of Malaya. Currently, he is Director of Nanotechnology and Catalysis Research Center (NANOCAT), University of Malaya. He gained his PhD in 2005 from Department of Physics, University of Malaya. He is the author in 300 peer-reviewed (ISI) papers with H-index 36. Prof. Rafie is well recognized internationally in the field of Nanotechnology. Testimony to this, he has been elected in Evaluation Panels for AET and ITR clusters and UPGP and for grants applications at UMRG, PRGS, FRGS and Qatar Foundation. He has been appointed as a panel for Yang di Pertuan Agong Scholarship and COMSTECs for Islamic Organization Country for evaluation of best scientific Chemistry papers for Muslim Scientist. He also secured funding as PI from the University of Malaya, Malaysian Government, Industry and International Grant. Prof Rafie has been appointed the editor-in-chief of The International Conference of Science and Engineering Materials (ICOSEM). Prof Rafie has been invited as a speaker to numerous talks and conferences and also Guest Editor for Symmetry (ISI journal) and editor for Asean Engineering Journal. He leads Nanomaterials Engineering Research Group of 48 PhD and 22 Master. These supervised students span over a quite broad scientific area going from science (chemistry, physics, material science, biology) to engineering (chemical, material). He is the recipient of 2021 Top Research Scientist Malaysia by Academy Science Malaysia and top 2% top scientist 2020 by Elsevier. He is also Founder and Editor in Chief of Malaysia Nanotechnology International Journal and Malaysian Catalysis International Journal.

4



MANAGEMENT



PROF. DR. WAN JEFFRY BASIRUN

Deputy Director of Nanotechnology & Catalysis Research Centre (NANOCAT)

Wan Jeffrey Basirun is currently a Professor in Electrochemistry and Physical Chemistry started his career in the department of Chemistry, University Malaya as the department undergraduate tutor in 1991 upon graduation in bachelors in Science with honors majoring in Chemistry, and proceeded with a PhD degree in electrochemistry in 1997 from the University of Southampton in United Kingdom in 1997. Since joining the active research groups in the department of Chemistry in 1997, he has supervised a total of 17 PhD and 7 Master students to completion, in addition have authored and co-authored more than 200 papers in journals indexed ISI web of knowledge, with a H-Index of 26. His appointment as the Deputy Director in NANOCAT in July 2018 is aimed to strengthen NANOCAT's niche research areas. His research interest is on the use of nanomaterials and nanocomposites in catalytic processes, sensors, biomaterials and energy conversion and storage. He also top 2% scientist in the world in 2020 by Elsevier.

5



ACADEMIC STAFF



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PhD, Chemistry
Uni. Kebangsaan Malaysia

Research Area
Chemistry of Catalysis
Biomass Energy Technology
Water and Wastewater Processes
Nanomaterials



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Nanomaterials
Magnetic and Semiconductor
Nanostructures
Composite Materials
Nanocomposites and Devices



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Management Solar
Energy Technology
Metal Oxide
Semiconductor Materials
Nanomaterials

6



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Catalysis
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Research Area
Synthesis
(Green Chemistry)
Organic Chemical Synthesis



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PhD, Materials Science
Madras University

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Nanomaterials
Nanocomposites
Biomaterials
Thin Films
Glass Materials
Photocatalysis,
Electrochemical Materials
Functional Materials
Crystal Growth



ASSOC. PROF. DR. LEE HWEI VOON
Associate Professor

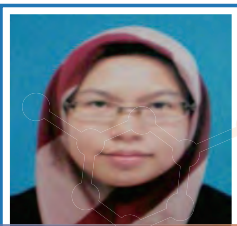
PhD, Catalysis
Uni. Putra Malaysia

Research Area
Biomass Conversion Technology
Oleochemical Technology
Catalysis
Nanomaterials

7



ACADEMIC STAFF



ASSOC. PROF. DR. NURHIDAYATULLAILI MUHD JULKAPLI
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Uni. Sains Malaysia

Research Area
Biopolymer
Biocomposites
Nanotechnology



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Uni. Malaya

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Organic Chemical Synthesis
Organic Chemistry
Medicinal
Natural Products



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Uni. Malaya

Research Area
Micro & Nanostructured Carbon
Wastewater Treatment
Biomass Valorisation
Fixed Bed Studies
Fibre Polymer Composite
Photocatalytic Studies

8



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Semiconductor Materials
Quantum Dots Materials
Optical Characterizations



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Semiconductor Materials
Processes
Reliability Physics of Devices
Flexible Electronics
Nanobiosensors



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PhD, Experimental Physics
Uni. Malaya

Research Area
Nanomaterials
Graphene-Based Composites
Electrochemical Materials (Sensors, Biosensors)
Polymer Composites (Natural Rubber)



DR. NAM HUI YIN
Lecturer

PhD, Tissue Engineering
Uni. Malaya

Research Area
Regenerative medicine
Tissue engineering
Mechanobiology
Stem Cells Biology
Nanomedicine

9



ADMINISTRATIVE STAFF



Nur'Adilah Md Jelani

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Afzalina Che Kob @Yaacob

Project Officer (N41)



Khairul Iskandar Baharom

Assistant Engineer (JA29)



Muhammad Nur Iman Amir

Research Assistant

10

TECHNICAL STAFF



Dr. Lee Kian Mun
Research Officer (Q47)



Durga Devi Suppiah
Research Officer (Q44)



Fatimah Zahara Abdullah
Research Officer (Q41)



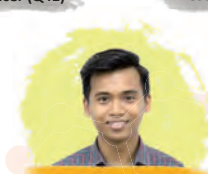
Noor Fariza Mohd Fawzi
Research Officer (Q41)



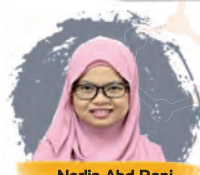
Nuramera Pa'dek
Science Officer (C41)



Farhana Abd Wahid
Assistant Science Officer (C29)



Mohamad Safuan Kamaruddin
Assistant Science Officer (C29)



Norlia Abd Rani
Research Assistant



Nur Azrin Daud
Research Assistant

11

ASSOCIATE MEMBER



PROF. DR. THONG KWAI LIN

Honorary Professor

Nanotechnology & Catalyst
Research Centre

Area of Expertise

Molecular Microbiology of
Foodborne
Nosocomial Bacterial Pathogens



PROF. DR. AZHAR ARIFFIN

Professor

Faculty of Science

Area of Expertise

Physical Organic Chemistry
Organic Chemical Synthesis



PROF. DR. WAN MOHD ASHRI
WAN DAUD

Professor

Faculty of Engineering

Area of Expertise

Materials Separation Process
Polymerisation Process
Catalyst and Reaction
Engineering



DR. LEO BEY FEN

Senior Lecturer

Faculty of Medicine

Area of Expertise

Catalyst
Nanomaterials
Advanced Imaging Techniques of
Materials & Life Sciences
Nanosafety and Toxicology
Assessment

12



ACADEMIC ICON



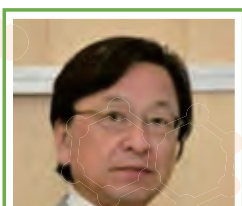
PROF. DR. SURESH KUMAR
BHARGAVA

**Associate Pro Vice
Chancellor**

College of Science,
Engineering and Health

Director

Centre of Advance Materials and
Industrial Chemistry
RMIT University,
Melbourne, Australia



PROF. DR. WATARU UEDA

Professor

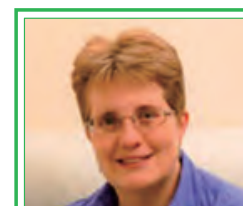
Dept. of Material and Life
Chemistry, Faculty of Engineering
Kanagawa University,
Kanagawa, Japan



PROF. DR. PANCHANAN
PRAMANIK

Distinguish Professor

Nanoscience Laboratory
Mathura,
GLA University,
Uttar Pradesh, India



PROF. DR. KAREN WILSON

Professor

Applied Chemistry and
Environmental Science.
School of Science Cluster
RMIT University,
Melbourne, Australia

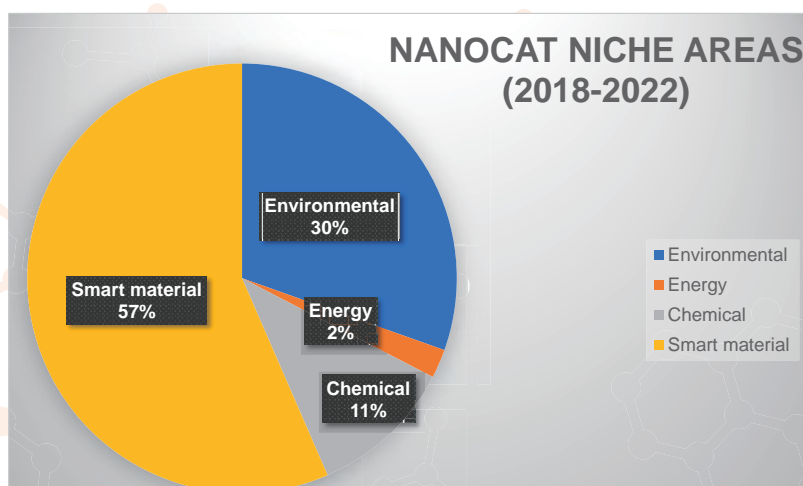
13



RESEARCH

NICHE AREAS | GRANTS | PUBLICATIONS
FACILITIES | POSTGRADUATE STUDENTS

NANOCAT NICHE AREAS



As a national research centre focused on nanotechnology and catalysis research areas, NANOCAT has come out with a strategic planning in research grant application. With that in mind, the emphasis has been given to four niche areas of NANOCAT which are environmental, smart materials, chemical synthesis and energy that aligned with the RMK-12, 10-10-mystie-framework, and Sustainable Development Goals (SDGs).

NICHE AREA

Smart Materials using Nanotechnology

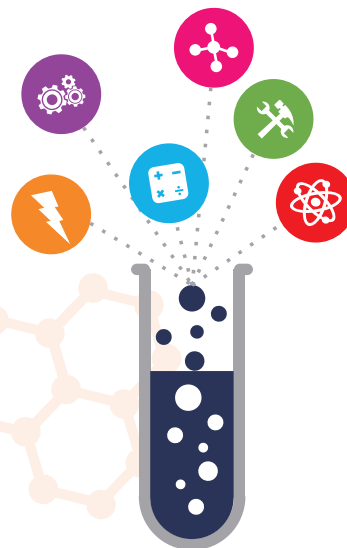
CO₂ Conversion & Gas Process | Biomass Conversion Route | Nanobiohybrid
| Nanocoating | Nanocomposite | Biosensors / Electrode | NanoAdditives

Nanocatalyst | Nanomagnetic Materials | Nanocarbon (CNT, Graphene) |
Nano-semiconducting Oxide | Nanocellulose | g-Carbon Nitride

Synthesis of Nano-antioxidant | Functionalization of Nanocellulose |
Conversion of Glycerol | Lignin To Value Added Chemicals | Polyols

Liquid Biofuel from Biomass | Bio-jet Fuel from Algae | H₂O Splitting |
Green Lubricant | Nanoadditives for Fuels & Lubricants | Fuel Cell | Solar
Cell

Photocatalysis for Mitigation of Water Pollutants | Nanofiltration | CO₂
Conversion | Endocrine Disrupting Micro-Pollutants, Pathogens, POPs

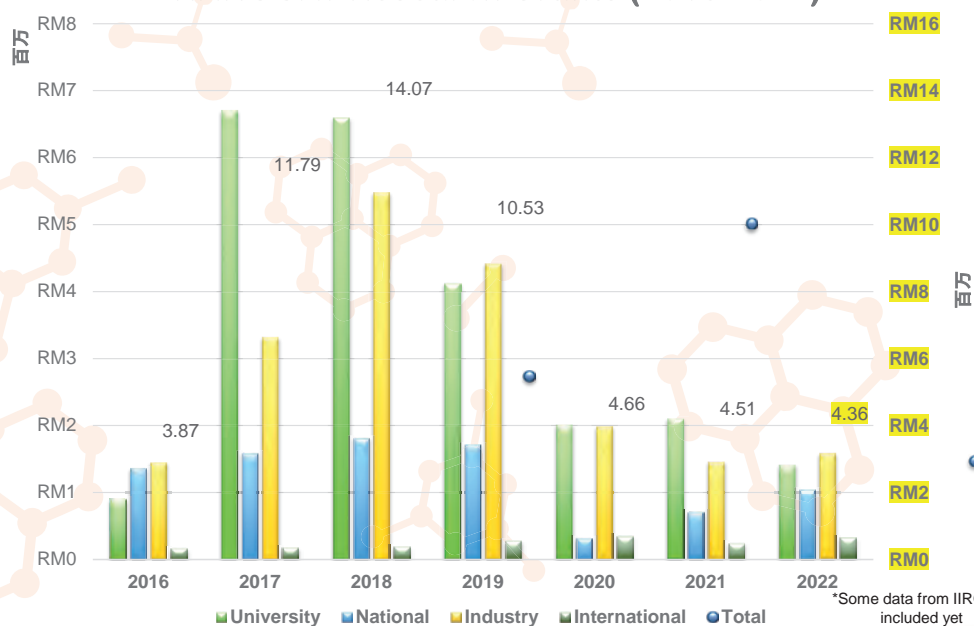


15



GRANTS

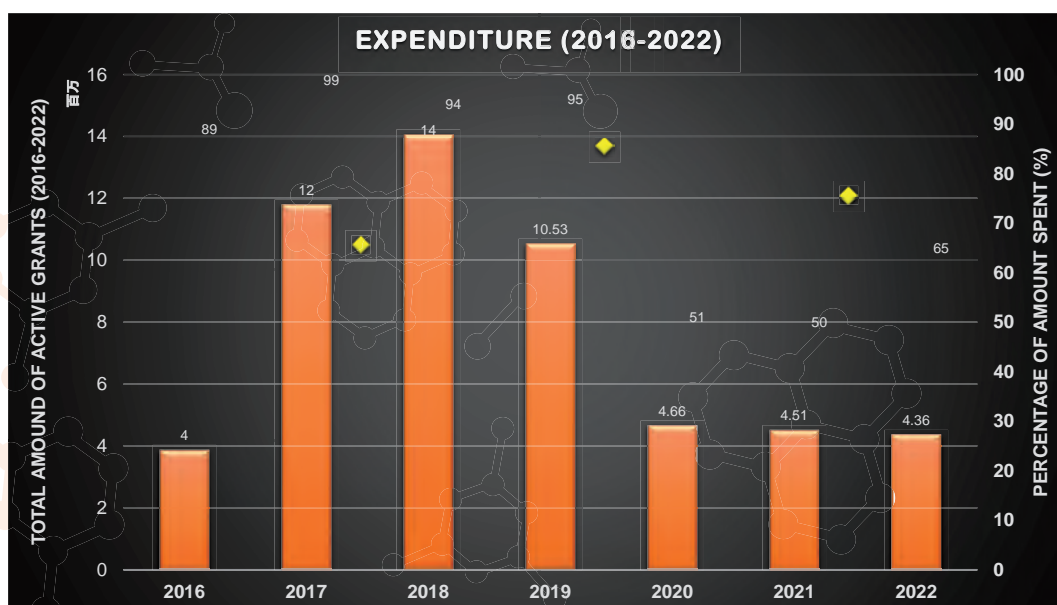
NANOCAT Research Grants (2016-2022)



16



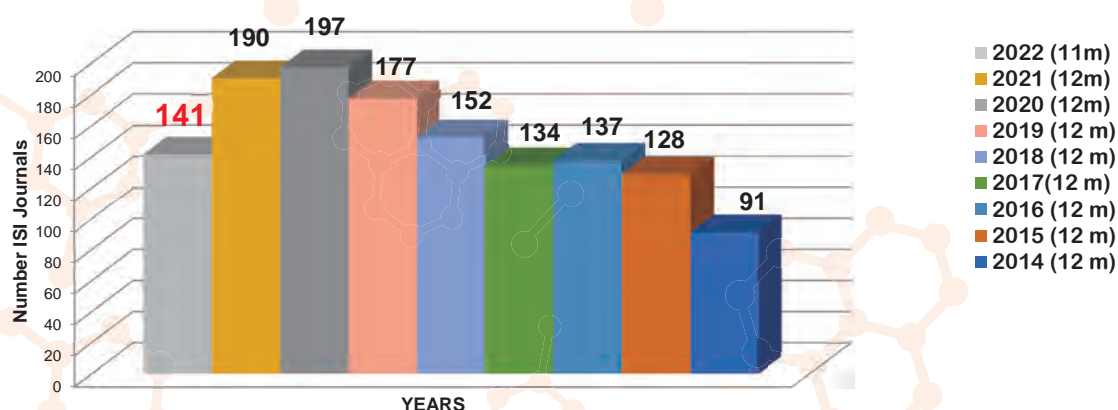
GRANTS



17

PUBLICATION ANALYSIS

ISI PAPERS_NANOCAT (UM) INDEXED IN WOS (2014 – 2022)
AS OF 30th NOVEMBER 2022



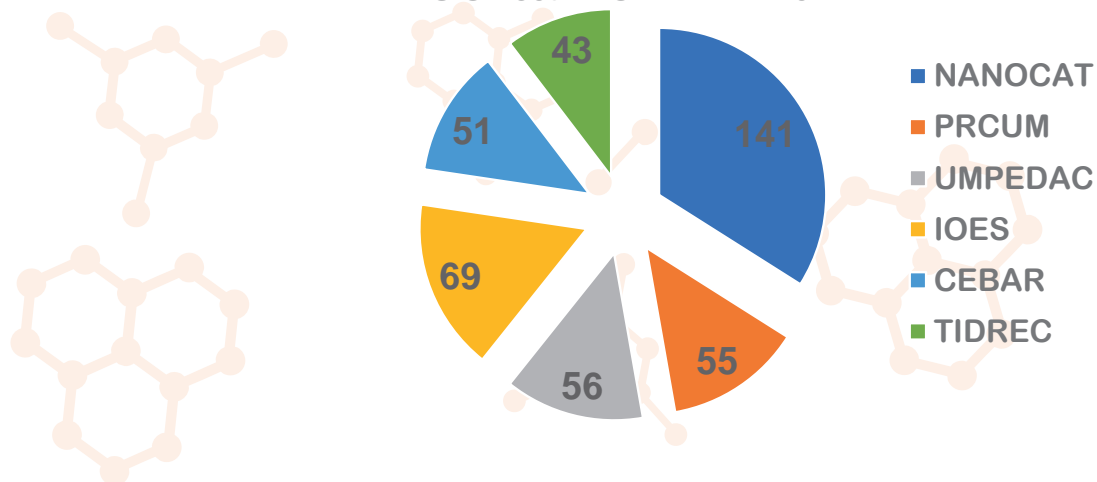
2021 UM PAPERS INDEXED IN WOS ACCORDING TO UM CENTRE OF EXCELLENCE (6 UMCoEs)

6 UM CENTRE OF EXCELLENCE	NO. OF PAPERS
NANOTECHNOLOGY & CATALYSIS RESEARCH CENTRE (NANOCAT)	190
PHOTONIC RESEARCH CENTRE (PRCUM)	48
POWER ENERGY DEDICATED ADVANCED CENTRE (UMPEDAC)	40
INSTITUTE OF OCEAN & EARTH SCIENCES (IOES)	95
CENTRE FOR RESEARCH IN BIOTECHNOLOGY FOR AGRICULTURE (CEBAR)	41
TROPICAL INFECTIOUS DISEASES RESEARCH & EDUCATION CENTRE (TIDREC)	55

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PUBLICATION ANALYSIS 2022

2022 UM PAPERS INDEXED IN WOS ACCORDING TO
UM CENTRE OF EXCELLENCE (6 UMCoEs) -
AS OF 30th NOVEMBER 2022



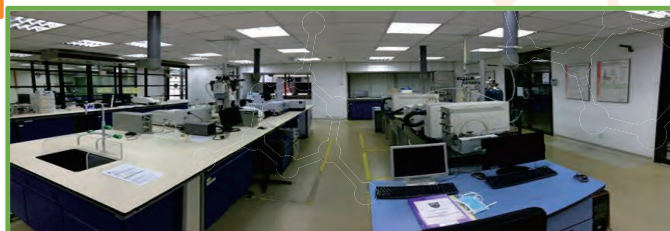
19

FACILITIES



NANOCAT TECHNICAL SERVICES SPECTROSCOPIC HALL

The Spectroscopic Hall, a laboratory within NANOCAT, focuses on determination of physical and chemical structural properties, chemical properties, morphological and texture properties, for liquid, semisolid and solid samples



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FACILITIES

NANOCAT TECHNICAL SERVICES

X-RAY HALL

X-Ray Hall provide a non-destructive technique to determine phase composition of solid materials



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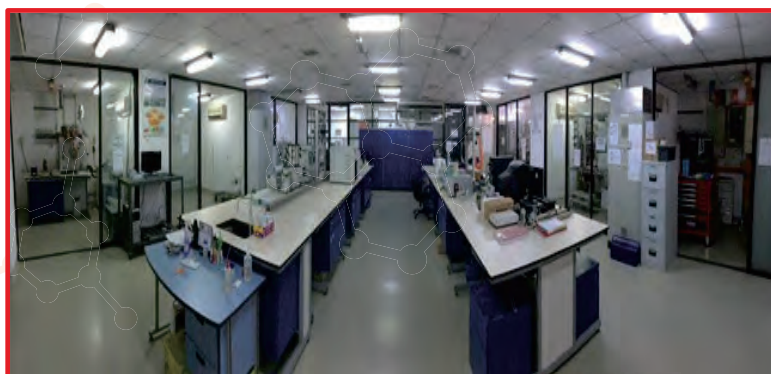
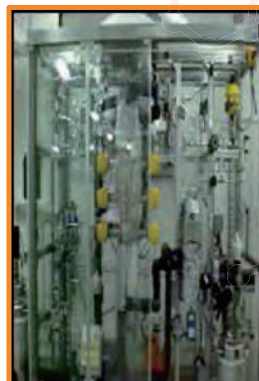
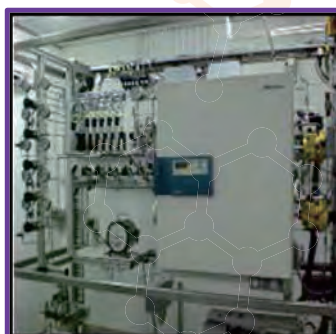


FACILITIES

NANOCAT TECHNICAL SERVICES

REACTOR HALL & COMBINATORIAL HALL

Reactor Hall focuses on catalytic performance screening and testing especially for petrochemical & bio oil industries. Equipped with GC to quantitatively analyze the reaction products to study the reaction mechanism allowing a reaction selectivity and yield to be optimized.



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POSTGRADUATE STUDENTS

NANOCAT takes pride to attract and supervise **70 POSTGRADUATE STUDENTS** (51 PhD and 19 MPhil) where **11** of them successfully **GRADUATED IN 2022** (6 PhD and 5 MPhil). As a global choice of research Centre of Excellent, **20%** of them are **INTERNATIONAL STUDENTS**. This is indeed an achievement as part of the effort to promote UM at international level



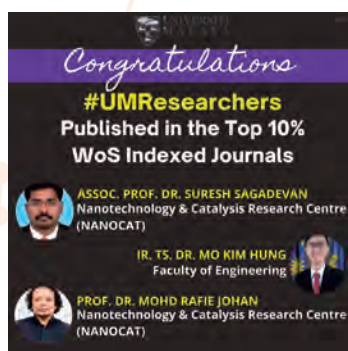
23



MILESTONES

AWARDS & DISTINCTIONS | PATENTS | PILOT PLANT
INTERNATIONALIZATION & NETWORKING | SEMINARS & TRAININGS |
CONFERENCE

AWARDS & DISTINCTIONS



Congratulations to Prof. Dr. Mohd Rafie Johan, Assoc. Prof. Dr. Suresh Sagadevan, and Assoc. Prof. Dr. Lee Hwei Voon on the incredible success of published in the top 10% Web of Science (WoS) Indexed Journals.

Congratulations to Prof. Dr. Mohd Rafie Johan, Prof. Dr. Wan Jeffrey Basirun, Assoc. Prof. Ir. Ts. Dr. Lai Chin Wei, Assoc. Prof. Dr. Juan Joon Ching, Assoc. Prof. Dr. Nader Ghaffari Khaligh, and Assoc. Prof. Dr. Suresh Sagadevan, Prof. Dr. Sharifah Bee O.A Abd Hamid (Allahyarhamah), Assoc. Prof. Dr. Lee Hwei Voon, Assoc. Prof. Dr. Nurhidayatullaili Muhd Julkapli, Dr. Zaira Zaman Chowdhury, Dr. Lee Kian Mun are listed among world's top 2% scientists 2022

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AWARDS & DISTINCTIONS



Congratulations to Associate Prof Dr Juan Joon Ching and Professor Dr Mohd Rafie Bin Johan teams for the high achievement won two medals (Gold and Bronze) in PeciPTA 2022 for innovation in two prototypes:

- 1) Smart Photoactive Air Purification Curtain Fabric (Fresh Air Curtain)
- 2) A Kit for Detecting Multiple target DNA Species in Food

25



Congratulations Mr. Koh Jin Kwei for the 4th place (consolation prize with rm 100) in Pertandingan Penyelidikan Inovasi Nanoteknologi (PIN) Program Nano Kebangsaan 2022



AWARDS & DISTINCTIONS



Grant award ceremony for FRGS 2022. Congratulations to Associate Professor Dr Nurhidayatullaili and Dr Yasmin.



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AWARDS & DISTINCTIONS



Congratulations to Ms. Phoon Bao Lee for awarding the 1st place in VIRTUAL UM3MT COMPETITION @ FACULTY LEVEL

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AWARDS & DISTINCTIONS



Most Impactful
academia industry
collaboration awards
2021



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PATENTED INNOVATIONS

No.	Year	Technologies/ Product/ Process	Researchers	Patent Pending No.	Filing Date
1	2016	Graphene quantum dots as lubricant modifier (New title: Method of preparing graphene quantum dots for use as a lubricant modifier)	Dr. Samira Bagheri, Prof. Dr. Sharifah Bee Abd Hamid	PI2016701084	25-Mar-16
2	2016	Double gene targeted multiplex PCR kit for the detection and differentiation of beef, buffalo and pig derived materials in food chain.	Dr. Md Eaqub Ali, Prof. Dr. Sharifah Bee Abd Hamid, Dr. M.A. Motalib Hossain	PI2016701716	12-May-16
3	2016	New method for the synthesis of semicarbazones (New title: A method for preparing semicarbazones)	Dr. Wageeh Abdulhadi Yehya Dabdoub, Prof. Dr. Azhar Ariffin, Abeer Abdulhadi, Prof. Dr. Noorsaadah Abd Rahman	PI2016704193	14-Nov-16
4	2017	New type of red algae marine biomass gelidium elegans-derived cellulose nano-materials (New title: Cellulose nanomaterials and method of obtaining thereof)	Dr. Lee Hwei Voon, Prof. Dr. Phang Siew Mooi, Dr. Juan Joon Ching, Chen You Wei	PI2017705013	24-Dec-17

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PATENTED INNOVATIONS

No.	Year	Technologies/ Product/ Process	Researchers	Patent Pending No.	Filing Date
5	2020	High capacity dual ion battery based on carbon fiber and perovskite (New title: High capacity metal dual ion battery, perovskite-based metal oxide anode and method of preparing the same)	Juan Joon Ching, Phang Siew Moi, Lai Chin Wei, Christelle Pau Ping Wong, Lee Kian Mun	PI2020001883	13-Apr-20
6	2020	A novel method to scarify hard seed coay of macuna bracteata, a plantation legume (New title: Apparatus for scarifying seeds)	Yarub Abdul Rahman Al-Douri, Dr. Ghassan Jayed Zaidan, Prof. Dr. Mohd Rafie Johan	PI2020002411	18-May-20
7	2020	Dispersion of graphene natural rubber latex composites for flexible wearable pressure sensor (New title: Method of preparing graphene dispersed rubber composites)	Marlinda Ab Rahman, Goh Boon Tong, Rafie Johan, Nurul Hazierah Kamaruddin, Nor Aliya hamizi, Zaira Chowdhury	PI2020002766	01-Jun-20

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PATENTED INNOVATIONS

No.	Year	Technologies/ Product/ Process	Researchers	Patent Pending No.	Filing Date
8	2021	Heptaplex PCR Kit for the detection and differentiation of cow, buffalo, chicken, duck, goat, sheep and pig species in food products.	Mohd Rafie Johan (50) Dr. M.A Motalib Hossain (50)	PI2021000958	23-Feb-21
9	2021	Increasing of Aquaculture Organism's Hatching Rate (New title: An Apparatus for magnetising water for the aquaculture system.	Yarub Abdul Rahman Al-Douri (48) Dr. Saddam Mohamad Hassan (50) Mohd Rafie Johan (2)	PI2021001521	13-Mar-21
10	2021	Original Title: Photoactive Graphene Oxide-TiO ₂ Fabric As Air Purifying New Title: A Photoactive Fabric For Purifying Air And A Method Of Producing Thereof	Juan Joon Ching Tyrus Tai Xin Hong Ivan Tay Jenn Hau Mohd Rafie bin Johan	PI 2021004756	19-Aug-21

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PATENTED INNOVATIONS

No.	Year	Technologies/ Product/ Process	Researchers	Patent Pending No.	Filing Date
11	2022	A SYSTEM AND METHOD FOR SIMULATING AND CONTROLLING A MICROBIAL FUEL CELL	Yasmin Abdul Wahab Muhammad Nihal Naseer Syed Asad A. Zaidi Juhana Jaffar	PI 2022001935	13-Apr-22
12	2022	Indolenine Comprising Antibiofilm Compounds And Uses Thereof (New Title: AN INDOLENINE DERIVATIVE FOR INHIBITING BIOFILM FORMATION BY STAPHYLOCOCCUS AUREUS)	Dr. Chee Chin Fei Profesor Dr. Tay Sun Tee Yap Cheng Hong Profesor Madya Dr. Kiew Lik Voon Abdul Qaiyum Bin Ramle Dr. Chin Sek Peng	PI 2022006315	9-Nov-22
13	2022	on-corrosive substituted 2,5-dimercapto-1,3,4-thiadiazole compounds as excellent lubricant additives (New Title: NON-CORROSIVE AND ASHLESS LUBRICANT ADDITIVE, LUBRICANT COMPOSITION AND METHODS THEREOF)	Profesor Madya Dr. Juan Joon Ching Ong Chiu Ling	NANOCAT	PI 2022006347

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PATENT GRANTED

No.	Technologies	Researchers	Patent Pending No.	Patent Granted No.	Date Patent Granted
1	Glove	(Prof Sharifah Bee O.A Abd Hamid, Tai Mun Foong , Ong Hun Tiar)UM & (Mohd Zaidi Mat Satar, Kuan Kam Hon, Kuan Mun Leong, Kuan Eu Zin, Chiah Mei Ling) Hartalega	PI 2015002581	MY-175863-A	14-Jul-20
2	Catalysts For Alkane Or Alkene Oxidation And Ammoxidation	Sharifah Bee Abd.Hamid, Andre' Sijpkens , Nelleke Schroeder-van der Puil	UI 20040763	MY-179510-A	9-Nov-20
3	New method for the synthesis of semicarbazones (New title: A Method for Preparing Semicarbazones)	Wageeh Abdulhadi Yehya Dabdawb, Azhar Bin Ariffin,Abeer Abdulhadi, Profesor Dr. Noorsaadah Binti Abd Rahman	PI 2016704193	MY-181672-A	31-Dec-20
4	Photocatalytic Gas Conversion Reactor	Profesor Madya Juan Joon Ching,Dr. Lai Chin Wei,Dr. Lee Hwei Voon,Hong Kok Yong,Profesor Dr. Sharifah Bee Binti O.A Abd Hamid	PI 2014701037	MY-186278-A	2-Jul-21

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INDUSTRIAL PROJECT PILOT PLANT

Nanotechnology and Catalysis Research Centre (NANOCAT) has partnered with Hartalega Sdn Bhd to develop and commercialise nanomagnetite metal detectable nitrile gloves, which is a safety product for the food and pharmaceutical industry. Torn pieces of this product can be detected by metal detectable equipment down to sizes of 3mm x 3mm. The core of the project is based on the development of technology to make the gloves detectable in the electro-magnetic field by doping the NBR latex glove with super-magnetic iron oxide nanoparticles (nanoMAG). To fulfil the production of need of industrial counterpart (Hartalega Sdn Bhd), a UM research team under the supervision of Prof. Rafie Mohd Johan and Dr. Leo Bey Fen has designed a semi-automated pilot plant located at the UM Research Incubator Building. This pilot plant with a capacity of 300L can be estimated to produce 100 kg of nanoMAG per batch capacity per day. These nanoMAG additives will then be further processed by Hartalega to produce approximately 200,000 pairs of gloves per day as requested by its Japanese customers, Midori Anzen (Japan). The potential for such a glove is significant not only for Japan but on a global scale. Hartalega being an export-based manufacturer would want to innovate and deliver the next wave of innovative nanoMAG gloves for the food processing and handling market.



Title: **Modification of Existing Nitrile Latex with Iron Oxide Nanoparticle**

Phase 1: 21 Mei 2013 - 22 Mei 2015 (Lab scale)

Phase 2: 1 Oct 2015 - 30 Sep 2019 (Design of Pilot Plant)

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INTERNATIONALIZATION & NETWORKING



NANOCAT has invited well known scientist from national and international to give **SEMINAR AND WORKSHOP**. For examples, we have invited Prof. Wataru Ueda, Prof. Geoff Thornton, Prof. S. Arumugam, etc. Our **SMART AND STRATEGIC** partnership is part of our initiative in internationalization and to gain visibility. The increasing number of international eminent scientists visiting NANOCAT, is another achievement witnessing **WORLD CLASS SCIENTISTS** such as Prof P. Pramanik, Suresh Bargava, Prof Ong Tiow-Gan, and others spending time in NANOCAT. Besides, NANOCAT has also actively engaged with industry to secure **RESEARCH COLLABORATION**.

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SEMINARS



14 December 2022
10:00 – 11:00 am
Webinar

Decarbonization of Energy Industry Through Renewable Energy and Green Technology Approaches



Ir. Noraziah Bt Muda

Invited Speaker

Head of Renewable Energy & Green Technology Unit
TUM Research-Site Asia

Microsoft Teams
<https://tumor.com/4guzazj>

Moderator: Dr. Lee Ching Shya





Free admission time and join us

Jointly organized by







TRAININGS



Raman Spectroscopy Workshop: Theoretical and Hands-on



Webinar on Advanced Materials in Nanotechnology & Catalyst 2021

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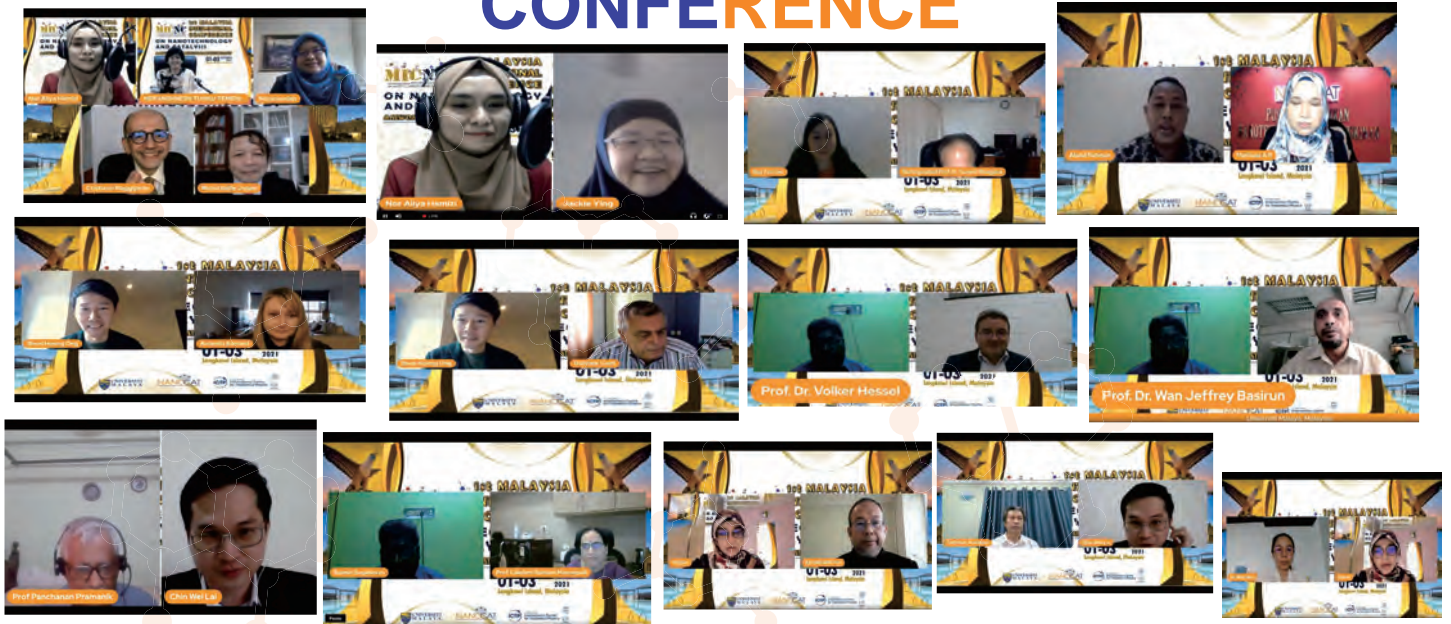
CONFERENCE



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CONFERENCE



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PARTNERS

COLLABORATORS | MEMORANDUM OF UNDERSTANDINGS
MEMORANDUM OF AGREEMENTS



COLLABORATORS



Intensification in networking and research collaboration were formalized through 17 MOUs (7 national and 10 international), 11 MOAs (7 national and 4 international). The co-operation has given mileage for joint publications in WoS journals with high impact and NDAs (1 national and 2 international).



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MEMORANDUM OF UNDERSTANDINGS

International

1. University of Surabaya, Indonesia
2. Flinders University, Australia
3. University of Messina, Italy
4. National Research Tomsk State University, Russian Federation
5. Shenyang National Laboratory for Materials Science, China
6. Guilan University, Iran
7. University of the Western Cape, South Africa
8. Iraqi Forum for Intellectures and Academics, Turkey
9. Peace University, The Republic of The Sudan
10. Wajufu Investment Holdings Co. Ltd, China

National

1. Universiti Malaysia Sarawak (UNIMAS)
2. Universiti Sains Malaysia (USM)
3. Universiti Malaysia Perlis (Unimap)
4. Universiti Teknologi Mara (UiTM)
5. Universiti Tunku Abd Rahman (UTAR)
6. Universiti Tun Hussein Onn Malaysia (UTHM)
7. Universiti Teknologi Petronas

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MEMORANDUM OF AGREEMENTS

International

1. UMT-Uni of Nottingham-UKM-Airbus, UK
2. University of Dhaka, Bangladesh
3. Ajinomoto Co. Inc., Japan
4. Kanagawa University, Japan

National

1. Hartalega Research Sdn Bhd
2. Karex Industries Sdn Bhd
3. Oleon Sdn Bhd
4. NGL Tech Sdn Bhd
5. Universiti Tun Hussein Onn Malaysia (UTHM)
6. Synergy Lite Sdn Bhd
7. International Islamic University Malaysia (IIUM)

NANOCAT PRODUCT

NANOCAT PRODUCTS



NANOCAT PRODUCTS

Visit here for purchase:
<https://www.fusionnano.com/>

Please find attached NANOCAT products price list for price/unit, description, product advantages and purchase

For further information please contact us at +603-7722 2487 or sales@fusionnano.com

PRODUCT NAME LIST:

1. Highly Concentrated Graphene Oxide
2. Highly Dispersed Graphene Oxide Solution
3. Gel-like Graphene Oxide
4. Crude Graphene Oxide
5. Highly Stabilized Graphene Oxide
6. Graphene Powder
7. Graphene Oxide Flakes
8. Spongy-like Graphene Oxide
9. Flower-like ZnO/Graphene Nanocomposites
10. Rod-like ZnO/graphene nanocomposites



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NANOCAT PRODUCTS



UNIVERSITI MALAYA NANOCAT
NANOTECHNOLOGY AND CATALYSIS RESEARCH CENTER

Nanotechnology and Catalysis Research Center (NANOCAT), since 2012 instrumental in spearheading Research, Development & Commercialization of catalysis and nanotechnology towards sustainability and green technology for all interested parties.

Looking forward to Profitable Partnership

For more information please contact:
Dr. Leong Yee Kah (Director) leongyk@um.edu.my
Dr. Durgadevi Suppiah (Deputy Director) durgadevi@um.edu.my
Dr. Noor Fariza Mohd Fawzi (Deputy Director) fariza@um.edu.my
Dr. Norlika Abd. Rani (Deputy Director) norlika@um.edu.my

High Precision Production with Advanced Quality Control Instruments

NanoCAT™ IronAgro
✓ IONP for Plant Iron Supplement. Absorbable by plant (foliar or root) with less loss and enhanced Fe ion bioavailability.

NanoCAT™ IronCoat
✓ IONP for Paint Iron Pigment with micaceous iron oxide use as a protective coating on steel structures and Polymer Coating with Metal and Magnetic properties.

NanoCAT™ IronMedic
✓ IONP for Contrast Agents in magnetic resonance imaging (MRI) and magnetic particle imaging (MPI).

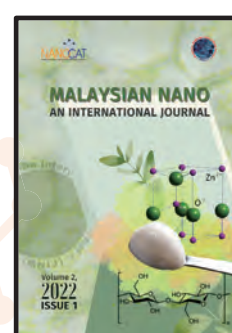
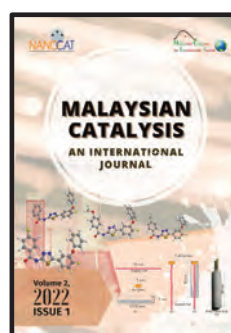
© Mohd Raffie Johan, Jahangir Kamalidin, Noor Fariza Mohd Fawzi, Leo Bey Fen, Durga Devi Suppiah, Afzalina Che Koo & Norlika Abd. Rani, 2021
Published by UM NANOCAT, edition 1, 22nd October 2021



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NANOCAT JOURNAL

NANOCAT JOURNALS



NANOCAT NEW PROGRAM



Closing date: 31st January 2023

OCTOBER/MARCH INTAKE

Master of Applied Sciences (Nanotechnology)

For more information, visit:

<https://nanocat.um.edu.my/nanotechnology>

Scan to apply



Or contact

Assoc. Prof. Dr. Ong Boon Hoong
Program Coordinator
bhong@um.edu.my
Tel: +603 7967 7022 (ext:2930)

Nanocat Office
nanocat@um.edu.my
+603 7967 6959



ABOUT THE COURSE

This programme is designed based on the current needs of nanotechnology industry and Industrial Revolution 4.0 (IR4.0) for Malaysia. It aims to support the National Policy of Science, Technology and Innovation (NPSTI) 2021-2030 and the 10-10 Malaysian Science, Technology, Innovation and Economy (MySTIE) Framework which launched early 2021.

Nanotechnology is the latest field that plays a very important role as advanced technology. The industry needs expertise in this field to generate revolutionary technologies and products that improve the living standards of local and international communities. The Master of Applied Science (Nanotechnology) program is a program that is highly relevant to the current needs of the nanotechnology industry. National Nanotechnology Centre (NNC) has forecasted to have additional 40,000 medium to high-tech workforce in the next 10 years. This program is able to produce graduates who have in-depth knowledge and skills required in the field of nanotechnology in line with current developments.

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ABOUT THE COURSE

October / March Intake

**MASTER OF APPLIED SCIENCES
(NANOTECHNOLOGY)**

**Open for MALAYSIAN &
INTERNATIONAL Candidates**

List of Subjects :	
Nanotechnology	Core Subjects (36 credit hours)
Research Methodology	
Dissertation	Elective Subjects (6 credit hours) (Select 2)
Design, Synthesis and Fabrication	
Characterization Techniques	
Nanosafety and Health	
Nanoelectronics	
Nanomedicine	
Nanobiotechnology	
Environmental Nanobiotechnology	Total Credit Hour : 42
Nanobiotechnology in Food and Agriculture	

UNIVERSITI MALAYA

NANCCAT

First in Malaysia, Flexible Mode, Unique upskilling and reskilling opportunities in Nanotechnology, Emerging technologies and nanomaterials and nanotechnology.

The Master of Applied Sciences (Nanotechnology) program is a program that is carefully crafted and highly relevant to the current needs of the nanotechnology industry. This program is capable of producing graduates who have in-depth knowledge as well as the necessary skills in the field of nanotechnology, in line with current developments. For the sustainability of the program, the syllabus for the courses offered will be evaluated from time to time according to the needs of the industry and sectors related to the application of impactful education practices. Feedback and surveys from graduates and employers are also used as a factor to assess the appropriateness of course offerings. This program is in line with the National Nanotechnology Policy and Strategy (DSNA) 2021-2030 and the National Policy of Science, Technology and Innovation (NPSTI) 2021-2030, with the aim to create a dynamic ecosystem and to drive Malaysia towards a high-income economy by 2030.

Programme Duration
One and a half year

Career Opportunities
Scientist, Technologist, R&D engineer, industrial expert and consultant, startup founder, chief technology officer, nanoscience and nanotechnology educator, specialist at industry and governmental agency.

For more information:
<https://nanocat.um.edu.my/nanotechnology>
nanocat@um.edu.my
 +603-7967 8939 Or
 Assoc. Prof. Dr. Ong Boon Heng (Program Coordinator)
Mong@um.edu.my
 +603-7967 7022 (ext. 2930)

Scan to apply:

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PERANCANGAN INISIATIF BAGI TAHUN 2023

BIL.	PTJ/PUSAT/UNIT	INISIATIF	TEMPOH JANGKAAN SELESAI	IMPLIKASI KEWANGAN (JIKA ADA)
1.	NANOCAT	Explore and identify the relevant research partner globally Form a regional research partnership, such as SATU platform, Industry partners, etc.	2025	-
2.	NANOCAT	To provide innovative solutions solving emerging global issues Intensify collaborative strategies between industry-academic to enhance research and evidence-based practice To secure more industry funding/investments and produce more talents and leaders through the collaboration project between industry and university	2025	-
3.	NANOCAT	Organize professional training workshop / seminar by prominent scientists and researchers for up-skilling and re-skilling programme for staffs and postgraduate students Continuous professional development (CPD) -nurturing more talents/ young staffs/ postgraduate students	2025	-



JANGKA MASA
PENDEK 2025

JANGKA MASA
PANJANG 2030

1. Program
Community- Based
Research &
Innovation

2. Program
Penyelidikan Muda

3. Program
Industri
Berfokus

RANCANGAN MALAYSIA KE- 12 (2021- 2025)

Ma la y s i a M a k m u r, I n k l u s i f, M a p a n

Objektif RMKe- 12 adalah untuk Malaysia mencapai status negara yang makmur, inklusif dan mampan sejajar dengan WKB 2030 dan Agenda 2030. Pertumbuhan ekonomi yang mampan akan membolehkan pengagihan ekonomi secara lebih adil, saksama dan inklusif kepada semua kumpulan pendapatan, etnik dan wilayah. Ini akan menyediakan taraf hidup yang lebih baik kepada semua rakyat Malaysia. RMKe- 12 juga merangkumi strategi dan inisiatif bagi memelihara keselamatan dan kedaulatan negara. Ini adalah penting untuk memastikan pembangunan sosioekonomi yang mampan.

Tema 1

Menjana Semula Ekonomi

Tema 2

Memperkuh Keselamatan, Kesejahteraan dan Inklusiviti

Tema 3

Melonjakkan Kemampanan

TEMA

Pemangkin Dasar 1

Membangunkan Bakat Masa Hadapan

Pemangkin Dasar 2

Mempercepat Penerimaan Teknologi dan Inovasi

Pemangkin Dasar 3

Menambah Baik Ketersambungan dan Infrastruktur Pengangkutan

Pemangkin Dasar 4

Memperkuh Perkhidmatan Awam

PEMANGKIN DASAR



SUMMARY

PENCAPAIAN GERAN PENYELIDIKAN

(sejak ditubuhkan)

Type of Grant	Amount received (RM)
University	10,979,092.00
National	8,547,346.00
Industry	8,716,532.10
International	714,795.73
TOTAL	28,957,765.83

PENCAPAIAN PENERBITAN

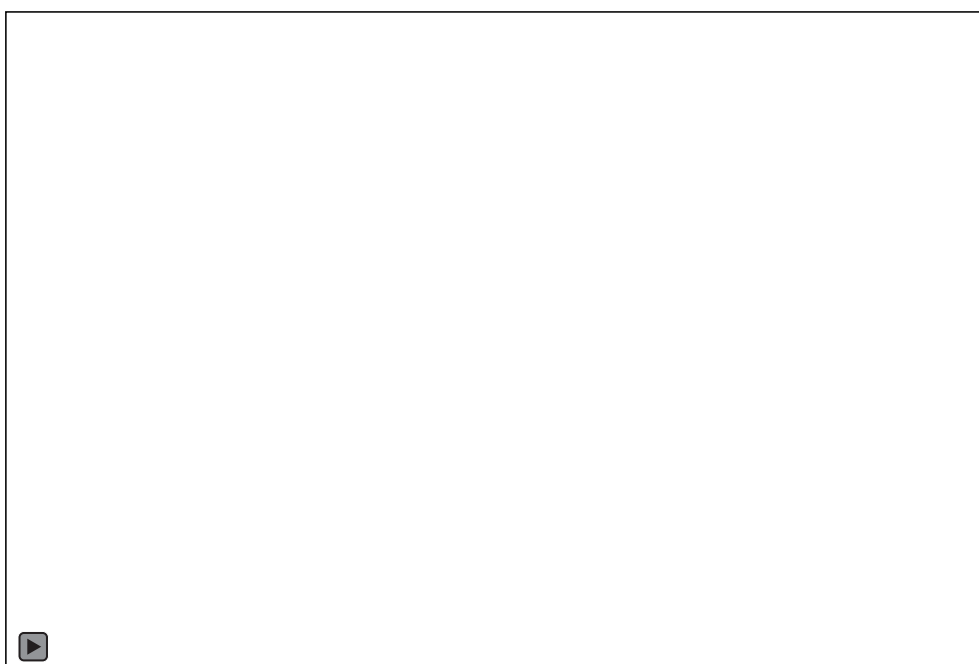
(sejak ditubuhkan)

ISI Journal	Total (Number)
Q1	510
Q2	476
Q3	265
Q4	137
TOTAL	1388

PROJEK- PROJEK BERIMPAK TINGGI

No	Nama Projek	Dana/ Geran penyelidikan	Penaja/ Pemberi Dana	Jumlah dana yang diterima	Tempoh Projek	Sasaran impak	Pemegang Taruh terlibat	Naratif impak
1	Development Of Low Cost And Efficient Recycling Processes Through Metal Reduction Of The By Product Of Sodium Borohydride (NaBH ₄)	Private	Nanomalaysia Berhad	500,000.00	1 year 6 months	Energy Industry	1) Nano Commerce Sdn. Bhd ; 2) Ministry of Science, Technology Malaysia	Complete Recyclability of raw materials for hydrogen production
2	Removal Of Ammoniacal Nitrogen, Bod, Cod And Odors From Industrial Wastewater Using Fabrication Of Granular Activated Carbon, Zeolite And Limestone	UM Innovate	Minister of Finance (MOF)	125,000.00	2 year 6 months	Industry like Rubber and palm oil	1) Vinca Solutions Sdn Bhd; 2) Department of Environment	Efficient Waste water treatment process flow system
3	Modification Of Existing Nitrile Latex With Magnetite Nano Particle-extension (Phase 2)	Private	Hartalega Sdn Bhd	780,000.00	2 years + 3 years (extended)	Rubber glove Industry	1) Hartalega Sdn Bhd; 2) Rubber Glove industry; 3) Food Manufacture	Detectable magnetic rubber glove for food processing industry
4	Development of Pilot Plant for Nanomagnetite Iron Oxide Slurry Project	Private	Hartalega Sdn Bhd	500,000.00	2 years + 3 years (extended)	Rubber glove Industry	1) Hartalega Sdn Bhd; 2) Rubber Glove Industry; 3) Food manufacture	Detectable magnetic rubber glove for food processing industry
5	Modification Of Existing Nitrile Latex With Magnetite Nano Particle-extension (Phase 1)	Private	Hartalega Sdn Bhd	656,900.00	2 years	Rubber glove Industry	1) Hartalega Sdn Bhd; 2) Rubber Glove Industry; 3) Food manufacture	Detectable magnetic rubber glove for food processing industry
6	Mass Production of Graphene Oxide	Private	Karex Industries Sdn Bhd	1,932,000.00	2 years	Rubber product stake holder	1) Karex Industries Sdn Bhd; 2) Rubber Industry	High strength and sustainable rubber product
7	Extreme Pressure Additives	Private	Oleon Sdn Bhd	1,000,000.00	2 years	Oil lubricant Industry	1) Oleon Sdn Bhd; 2) Lubricant Industry	New additive for enhancement of the oil lubricant properties
8	A Baseline Study : Co ₂ Methanation Catalyst And Performance Evaluation	Private	Petronas Research Sdn Bhd	980,763.62	7 months +2 months (extended)	Oil Petroleum Industry	1) Petronas Research Sdn Bhd; 2) Ministry of Energy and Environment Malaysia	Effective catalyst for CO ₂ conversion to Methane
9	Ester-based Bio Lubricant for Refrigerant System [Bio-Ester Refrigerant]	Private	Oleon Sdn Bhd	619,940.00	2 years+6 months (extended)	Oil lubricant Industry	1) Oleon Sdn Bhd; 2) Lubricant Industry	New additive for enhancement of the oil lubricant properties
10	Novel Nitrogen Heterocycle Compounds: Design, Synthesis and Evaluation of the Antiviral Activities Against Covid 19	International	JICA ASEAN University Network	207,348.00	2 years	COVID 19 patient	1) Ministry of Health Malaysia ; 2) COVID 19 patients	New drug to combat COVID 19

Research Scientist and Postgraduate Students doing Laboratory work at NANOCAT Laboratory



Acknowledgement

National Nanotechnology Centre
(NNC), Malaysia



67

THANK YOU

Visit: www.nanocat.um.edu.my

E-mail: nanocat@um.edu.my

Call: +603 7967 6959



National Nanotechnology Center (NANOTEC)

NANOTEC: established on 13 August 2003

VISION:

Research Agency of Excellence in Nanotechnology Innovation for National Economy and Society Upgrowth with Sustainability and International Recognition.

MISSION:

to conduct research, development, design and engineering in Nanotechnology, build excellent research capability with national and international collaborations and to transfer the developed technology or research outputs to industrial and social sectors in a constructive manner, to increase Thailand's competitiveness and economic growth, and improve quality of life under the social and environmental awareness.

NANOTEC
Move Forward To Better Future
a member of NSTDA



Dr. Wansee Chinsirikul
Executive Director



Asst. Prof. Dr. Tanakorn Osothchan
Deputy Executive Director
Research & Development

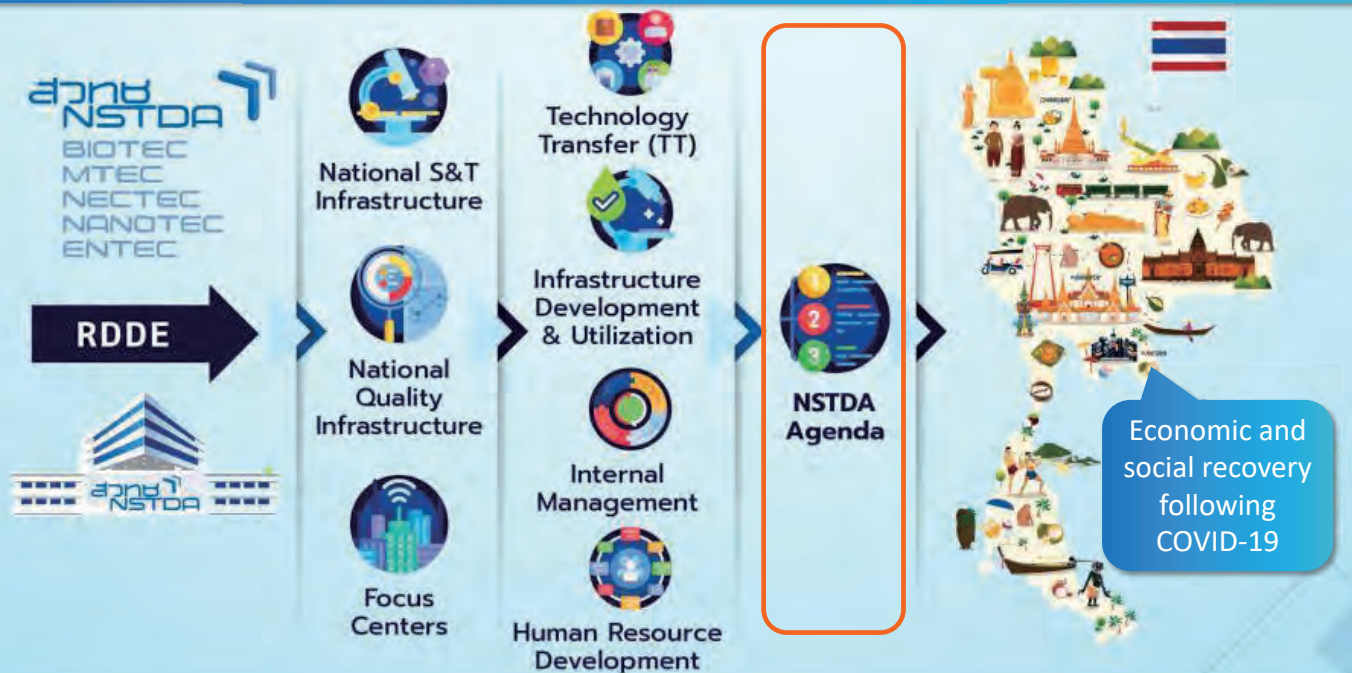


Dr. Suthee Phoojaruenchanachai
Deputy Executive Director
Organization Management



Dr. Pavadee Aungkavattana
Deputy Executive Director
Research & Development Support

NANOTEC/NSTDA Position

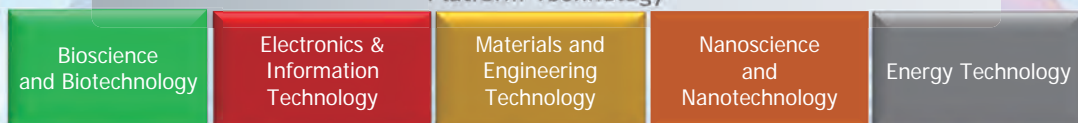


Important Operations of 4 target groups of NSTDA Agenda



Circular and Green Economy program meets the needs of building growth on the quality of life that is environmentally friendly. Reduce greenhouse gas emissions and work toward creating a low-carbon society.

Platform Technology



NSTDA Agenda : Health and Wellness
focus on technology development and innovation to meet health and medical needs which emphasize tools medical devices, pharmaceutical products, and vaccines

NANOTEC's Role to add Values to 4 Major Industries (Bio-Circular-Green)



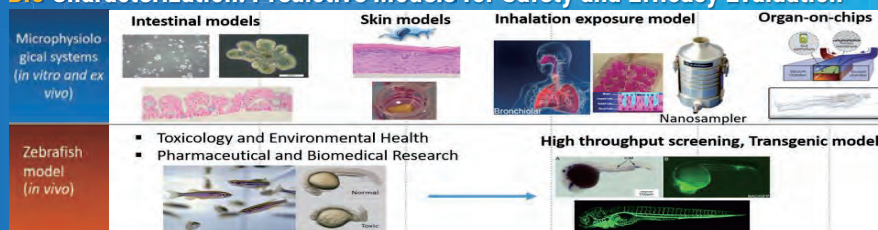
5

Physico-Chemical-Bio Characterization and Standardization

Physico-Chemical Characterization and Standardization



Bio Characterization: Predictive Models for Safety and Efficacy Evaluation



6

NANOTEC Pilot Plants (Scaling-up & Translational Research)

(1) Nanoparticles and Cosmetics Pilot Plant (GMP)

Translational Research: Bridging the gap between research and commercialization

- Semi-pilot upscale for clinical research
- Trial & Upscale production service for Start up/SME/Big company



Production Capability



Vacuum mixer 10 lt. (5-8 lt.)



Vacuum mixer 100 lt. (30-90 lt.)



High pressure homogenizer (5-8 lt.)



One nozzle filling machine for cream



Two nozzle filling machine for liquid



Packaging & labeling line



Mobile mixing tank 100 lt. (50-80 lt.)



Mobile homo mixer 100 lt. (40-100 lt.)



Tube filling (200 pcs./hr. max.)

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(2) Nanotextile Coating Pilot Plant (ISO 9001:2015)



Multifunctional Nanocoating of fibers, yarns, and fabrics

- ✓ Customer-centric service
- ✓ Product warrantee
- ✓ Process quality
- ✓ Consultation
- ✓ Cost optimisations



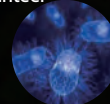
Perfume Finish
Smell identification by volunteer



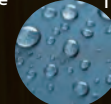
Anti-UV Finish
Gray Scale for Color Change



Softening Finish
AATCC Test Method 66: 2008



Antibacterial Finish
AATCC TM 100:2004



Water Repellent Finish
AATCC 22:200

7

Cooperation on Nanosafety in ASEAN



Aim: Leading on Nanosafety in ASEAN

ANF
Asia Nano Forum

Capability on Nanosafety

OECD
BETTER POLICIES FOR BETTER LIVES

INISS nano

NANOTEC
Move Forward To Better Future

ASEAN



8

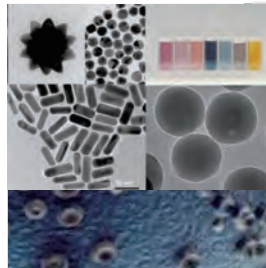
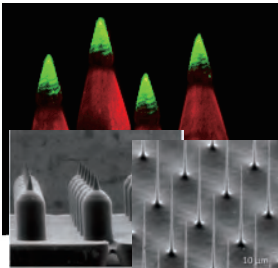
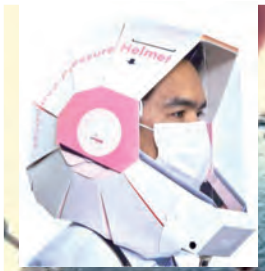
Build expertise & visibility with partners both domestically and internationally. NETWORK & COLLABORATION STRATEGY



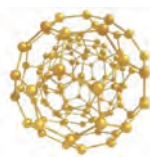
Nanotechnology user facility Network (Japan-NANOTEC)



Design and synthesis of **functional/stimuli-responsive nanomaterials and indicators** to improve quality of life and integrate smart **devices and nanoscale architectures** into systems that provide substantial advantages and capable of detecting and remediating automatically and cohesively



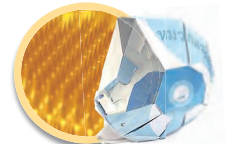
Responsive Materials and Nanosensor (RMNS) Research Group



Responsive Nanomaterials (RNM) Team



Nanodiagnostics device (NDx) Team



Nanorobotic System & Nanoneedle Research Team (NRN)Team

Research highlights:



Research highlights:

Respiratory tract infections

- ✓ **COVID-19 screening**
- ✓ **Technology:** Lateral flow Thailand FDA approval> Professional Use & Self test
- ✓ **Sample:** **Nasopharyngeal Swab/ Nasal Swab**



NANO Covid-19 Antigen Rapid Test (TRL 9)



NanoFlu Rapid Test (TRL 6)

- ✓ **Flu A & B Screening**
- ✓ **Technology:** Lateral flow immunochromatographic assay (**LFA**)
- ✓ **Sample:** **Nasopharyngeal Swab**

Noncommunicable diseases (NCDs)



SugarAL GO-sensor (TRL 6)

- ✓ Glycated albumin detection for **diabetes mellitus screening & monitoring**
- ✓ **Technology :** Aptasensor
- ✓ **Sample:** **Serum/Plasma**



GO-sensor Albumin test (TRL 7)

- ✓ Albuminuria detection for **kidney function screening**
- ✓ **Technology :** Aptasensor
- ✓ **Sample:** **Serum/Plasma and Urine**



AL Strip (TRL 7)

- ✓ Microalbumin screening
- ✓ **Technology:** Lateral flow immunochromatographic assay (**LFA**)
- ✓ **Sample:** **Urine**

Research Networking history



Jan. 2016



Jan. 2017



Jan. – Feb. 2018



Jan. 2019

Research Networking project

AIST Nanoprocessing Facility (NPF) Tsukuba Central 2

NPF has a group of equipment for nanofabrication and analysis which is capable of handling out of small pieces to 6 inch wafers. (Some devices are eligible to allow for up to 8 inch wafer) with generous assistance including the operation training. NPF provides opportunities such as technical consultations, supports and others, concurrently young researchers and engineers.

◇ Examples of the apparatuses ◇

i-Line Stepper: From chip sample to 8 inch wafer
ALD: Al2O3, SiO2, HfO2, ZrO2, Si3N4, etc.
Massless Lithography: Down to 1um size pattern without photomask
Nanoprobe system: Electrical measurement with nanoprobe in FB-SEM

In addition to the above, NPF has dry etching apparatuses, sputter deposition apparatuses, e-beam Writers, FIB, SIMS, XPS, and etc. More than 70 apparatuses can be utilized by users themselves or under technical assistance or substitution service for technical processing, and equipment utilization.

Contact: E-mail: nanpf-consultation@aist.go.jp
HP: <https://aist.openinnovation.jp/npf/>

AIST Nanocharacterization Facility (ANCF)

Development of nanotechnology, nanoscience, and their application
Driving research and development by analysis on atomic and nano order structure and surface state of new materials

Core technology

- World-leading elemental technique for measurement
- Development of cutting-edge analytical techniques and their own use through nanotechnology platform, Japan and global research

Approach, outcome

- Systematic demonstration
- Support for research and development of new materials by Universities and companies

SPMAAFM, NMR, Laser, EUPS

ibec ANCF

Spread effect

Support for research and development of new materials by Universities and companies

Nanopore fabrication

Super Cleanroom AIST

NPF, AIST

S4800 5.0kV 9.6mm x40.0k SE(U) 1.00um

Electrodes

Nanopore and membrane

Output on Nanopore Fabrication Research **patent:** Verification of Nanopore via Electrochemical method

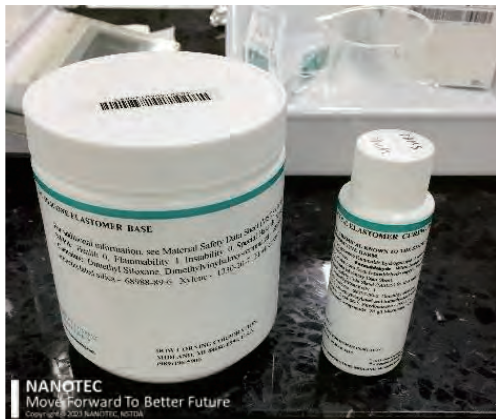
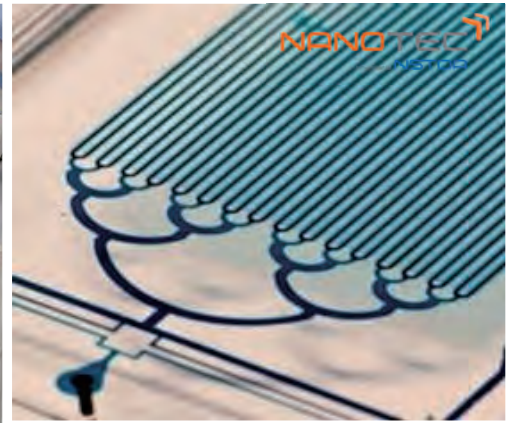
Sakura Training: 2016

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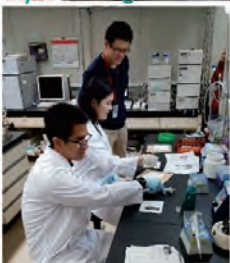
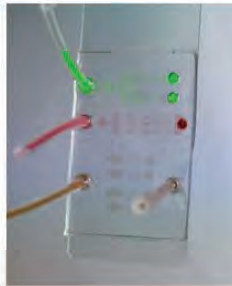
Nanotech Career-up Alliance
ナノテクキャリアアップアライアンス

TIA nano
Tsukuba Innovation Arena

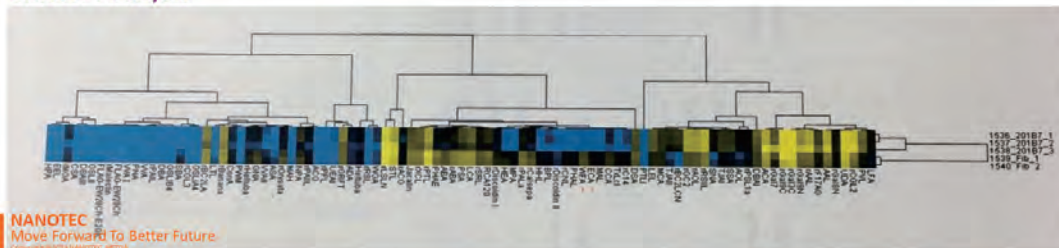
Sakura Training: 2017



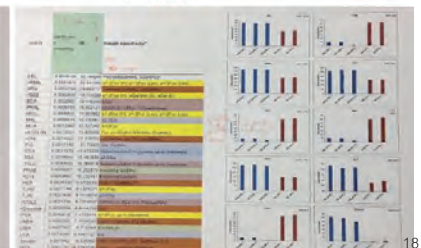
Sakura Training: 2018



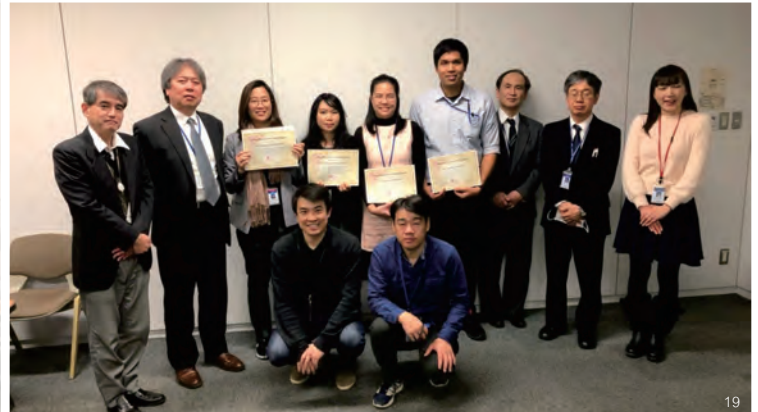
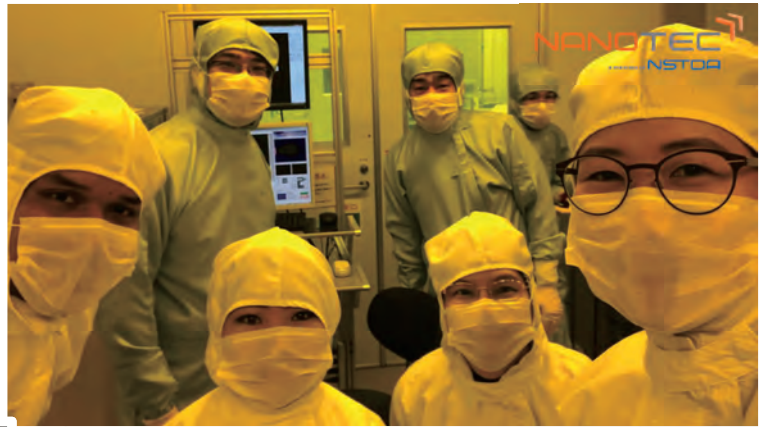
Cluster Analysis



T-test



Sakura Training: 2019



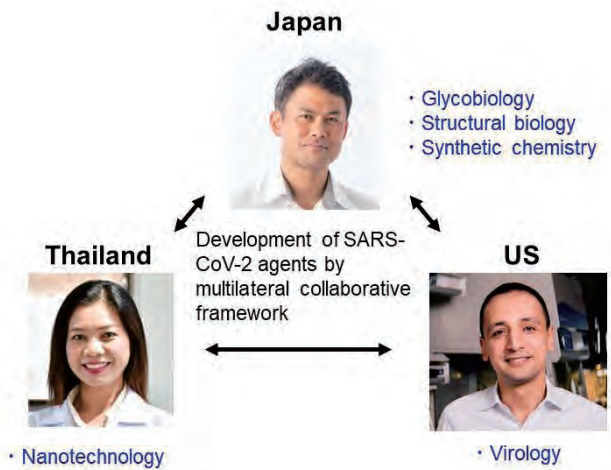
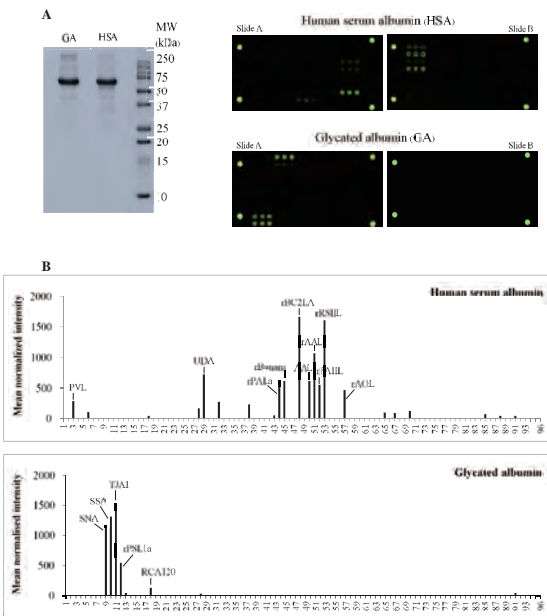
Output from Sakura Training & ongoing project

NANOTEC
a member of **NSTDA**

Lectin profiling and lectin-based assay for human serum albumin detection (In prep)

e-ASIA Joint Research Program (e-ASIA JRP) FY 2023

Development of neutralizing agents targeting glycopeptides highly conserved in SARS-CoV-2 mutant strains





NANOTEC
a member of NSTDA

National Nanotechnology Center (NANOTEC)

National Science and Technology Development
Agency (NSTDA), THAILAND

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<https://www.nanotec.or.th/en/>

**Thank you for
your attention**

“Nanotechnology in the Philippines: Research, Facilities, Nanosafety and Standards development”



Persia Ada N. de Yro, PhD
DOST-ITDI



DOST

Department of Science and Technology

- executive department of the Philippine Government responsible for the coordination and formulation of policies and projects in the fields of Science and Technology in support of national development

Technology Roadmap

Nanotechnology

2024 onwards

Manufacturing - Methods: Nanofabrication techniques for electronics and materials manufacturing (NEMS, memory tech, blow spinning)
Manufacturing - Materials: Adoption of advanced materials such as intermetallics, nanoclays and smart fibers

2024 onwards

- Improve workforce preparation for opportunities with multinational partners in areas such as Aerospace, ICT/Semiconductor, and Automotive

2023-2024

- Nanodelivery - Applications: Nanodevice fabrication for drug delivery and diagnostics (nanobots)
- Nanosensors - Applications: Agricultural detection of pathogens, pesticide residues and determination of crop quality

2023-2024

- Partner with at least 10 entities for R&D applications and infrastructure co-development (**Php 30M annually**)
 - Aerospace and Automotive (small-scale, low-tier local suppliers)
 - ICT/Semiconductor (local design and development firms)
- Improve workforce preparation for opportunities with multinational partners in priority areas such as Rail, Food/Agriculture, and Sustainable Environment

2022-2023

- Coating - Materials: Coatings of nanomaterials (e.g. Diamond-Like-Carbon (DLC), MAX phase) for lightweight & strength applications
- Manufacturing - Materials: Strong and light-weight materials from nanocomposites, nanocement, magnesium-alloys, etc.
- Nanodelivery - Applications: Nanofertilizers and nanovaccines to increase crop health and quality
- Nanosensors - Applications: Nanodiagnostic devices such quantum dots for health monitoring

2022-2023

- Introduce targeted training electives in Advanced Materials and Nanotechnology to promote employment readiness of graduates for certain industry applications
- Charge returnees from Global Research Program and Balik Scientist Program to consolidate resources and lead R&D and collaboration efforts in the field (through Advanced Materials and Nanotechnology Hub)

2021-2022

- Coating - Materials: Coatings of nanomaterials (ex. nano-structured polymers) for lightweight & strength applications
- Manufacturing - Materials: Nano-enabled materials from Natural/Indigenous raw materials and waste/by-products (bioplastics, nanocellulose, etc.)
- Nanosensors - Applications: Sensors to detect emerging diseases

2021-2022

- Establish programs to obtain visibility into industry needs and open channels for collaboration (e.g. internships, immersions, fora) (**Php 5.5M**)
- Partner with at least 10 entities for R&D applications and infrastructure co-development (**Php 30M annually**):
 - Agriculture/food (small-scale producers, processors, or manufacturers participating in the value chain)
 - Sustainability (LGUs)
 - Rail (Philippine Railway Institute, DOST-MIRDC)

2020-2021

- Manufacturing - Materials: Nanofiber materials as food packaging; Development of metal powder for additive manufacturing
- Nanosensors - Applications: Smart packaging; Sensors to detect harmful substances in food

2020-2021

- Increase awareness of Advanced Materials and Nanotechnology (uses, applications, standards and safety) in STEM curriculum, and in industry and among consumers
- Ensure communication of government policy incentives and benefits to stakeholders
- Build and publish database with information regarding technology researches, publications, laboratories and equipment, and skills developed
- Develop Global Research Program to send 10 researchers abroad to raise local talent to global standards by providing exposure and training in renowned research laboratories before returning to the Philippines to assume research Hub responsibilities (**Php 40M**)

Nanotechnology R&D Roadmap (2020-2024)

Input



Industrial Technology and Development Institute

DOST-ITDI undertakes multidisciplinary industrial R&D, technical services, and knowledge translation or technology transfer and commercialization.

ITDI harnesses know-how in new technology and product innovation.



Materials Science Division (MSD)

- spearheads R&D programs on materials essential to the development of local industries.
- generates quality R&D while harnessing the use of locally available resources in developing various materials for industrial purposes; and
- provides world class S&T services in materials science and engineering.



MATDEV R&D

COMPOSITE FILAMENTS FOR 3D PRINTING

Additive

Carbon Nano Tubes (CNT), Nano Zeolite,
Nano Precipitated Calcium Carbonate
(NPCC), Halloysite Nano Tubes (HNT),
Nano Alumina, Silica, Hydroxy Apatite,
Cellulose Acetate, Fiber Glass,
Montmorillonite, Wood Flour

Matrix + Additive

**POLYMER
MATRIX:
PLA / ABS /
PP / HDPE**

Filament feed

Print core

Nozzle

Build plate

FDM 3D Printer

Twin screw extruder

MATDEV R&D

COMPOSITE FILAMENTS FOR 3D PRINTING



Ear Relief Band (PLA/Silica)

Air Diffuser
(PP/NPCC)



Ratchemazing: Cable Organizer (ABS/MMT)



Cellulex: Plant Plot
(PLA/Cellulose
Acetate)



Osteogen: Artificial Bone (PLA/HAP)



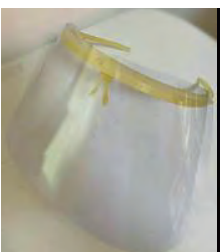
Keychain Multitool (PLA/CNT)



Gundam Suite: Orthopedic Cast (PLA/NPCC)



Durastic:
Cellphone Holder
(PLA/Alumina)



Virashield: Face
Shield (PLA/Nano
Zeolite)

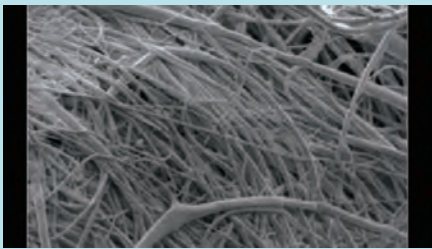


PolyPropy Sink Strainer (PP)



ReFil: an HDPE recycled filament

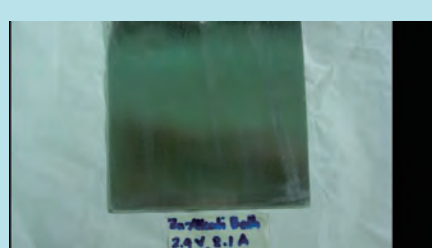
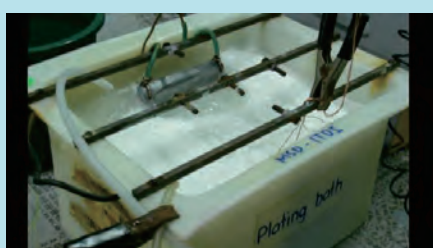
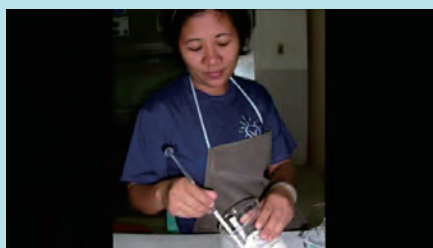
ADVANCED MATERIALS SECTION



SPECIAL MATERIALS SECTION



SURFACE ENGINEERING SECTION



Nanotech Researches

PROJECT TITLE	Implementing Agency
• Metal Oxide Hybrid Structured Barriers for Stable Energy Devices (SEA-EU)	DLSU Laguna Campus
• Photoluminescent metal nanocluster to detect, disinfect, and suppress the spread of coronavirus and other microorganisms	DLSU Laguna Campus
• Fabrication of Graphene-based Nanostructure Substrates for Applications in Ultrasensitive Detection	UPD-MSEP
• Fabrication and Characterization of Plasma Sprayed Nanostructured TiO ₂ - based Coatings for Photocatalytic Applications	MSU-IIT
• Development of Nanosilica-based Anti-Corrosion Coating Formulations for Carbon Steel Reinforcement Used in Farm Structures	UPLB-CEAT
Project 1: Nanofibrous Scaffolds from Natural Biomaterials for Tissue Engineering	DOST-ITDI
Project 2: Nanostructured Scaffolds from Natural Fibers as Platforms for Stem Cell Growth and Differentiation	UPD-NIMBB
• Kapok Fibers Absorbent With Switchable Hydrophobicity/ Hydrophilicity For Oily Water And Wastewater Treatment	UPD-DMMME
• Development of biodegradable nanofiber filters as an active material for medical-grade facemasks	USC
• Fabrication and Characterization of Hydrophobic Nanocomposite Plated Abaca Fabric for Enhanced Electromagnetic Interference Shielding (EMI-SE) and Thermal Resistance (TR) for Spacesuits Application	DLSU
• Environmental, Health and Safety Research in the Risk Assessment of Nanomaterials (Phase 1)	DOST-ITDI
• e-Asia project: Fundamental Study of the Physical Properties of Metal Oxide Single Nanowires and Nanoparticles for Bionanosensing	DLSU
• DOST-JSPS 2019: Radiation damage investigations on functional materials: Material development, analysis, and informatics	UPD-NIP
• Design of Highly Active Kapok Fiber Electrodes for Energy Applications	UPD-DMMME
• Center for Advanced Materials for Clean Energy Technologies based on Indigenous Materials (CAMCET)	UST
CAMCET 1: Biomass-Derived Nanomaterials as Novel Electrocatalyst Components for Direct Ethanol Fuel Cells	Mapua University
CAMCET 2: Fabrication of Nanostructured Silica-based Nanocomposite Membranes for Proton Exchange Membrane Fuel Cells (PEMFCs) Applications	
CAMCET 3: Plant-Derived Biochar as Fabric-Based Electrode Materials for Supercapacitor Devices	
• CARRAGEENAN RESEARCH & DEVELOPMENT LAB (CR&De-L): Developing Cold-Soluble Powders, Bioplastic Sheets, and Bioactive Hydrogels from Nano-Structured Carrageenans	USC
• SMART INK: Development of a 3D Printing Nano-Structured Carrageenan Hydrogel	USC



- **Synthesis and Characterization of Polymer Based Graphene Nanomaterials for Ship Hull Application**

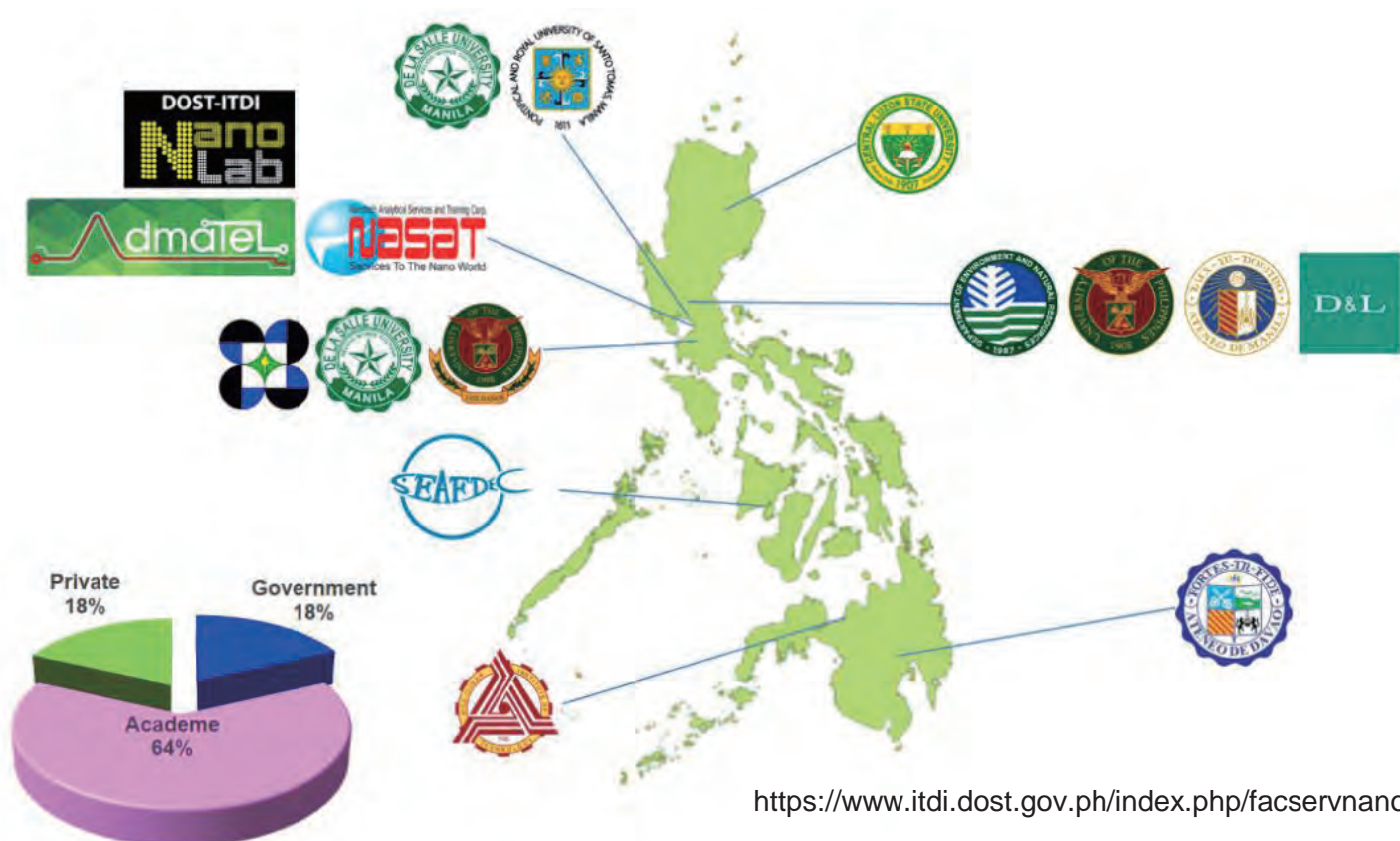
Nanosensors for Rubber Quality Assessment

List of Characterization Techniques for the Physical and Chemical Evaluation of Nanomaterials

Nanostructure Property	Characterization Technique(s)
Size / size distribution / Aggregation	TEM, SEM, DLS
Morphology	TEM, SEM
Surface Area	TEM
Chemical Composition	ICP-MS, Raman
Phase Information	XRD, TEM
Surface Chemistry	XPS, UPS, FT-IR, Inverse Gas Chromatography
Surface Charge / Adsorption	Zeta potential, IR, UV-vis
Dissolution Kinetics	Electrochemistry, ICP-MS, XAS

Experimental Techniques used in Nanoparticle Characterization in ITDI

Technique	Main information derived
X-ray Diffraction (XRD)	Crystal structure, composition, crystalline grain size
X-ray Fluorescence (XRF)	Elemental composition
Fourier Transform Infrared (FTIR)	Surface composition, ligand binding
Brunauer-Emmett-Teller (BET)	Surface Area
Thermogravimetric Differential Thermal Analyzer (TG-DTA)	Mass and composition of stabilizers
Dynamic Light Scattering (DLS)/Zeta Potential	Hydrodynamic size, detection of agglomerates
Transmission Electron Microscope (TEM)	NP size, size monodispersity, shape, aggregation state
Scanning Electron Microscope (SEM)	Morphology, dispersion of NPs in cells and other matrices
Atomic Force Microscopy (AFM)	NP size and shape in 3D mode



Name of Institution	Name of Laboratory	Instrumentations Available			
		AFM	DLS	SEM	TEM
Government Agencies					
Forest Products Research and Development Institute (FPRDI) – DOST	Nanocellulose Service and Testing Laboratory				
Industrial Technology Development Institute (ITDI) - DOST	Advanced Device and Materials Testing Laboratory (ADMATEL), Material Science Division (MSD)				
Industrial Technology Development Institute (ITDI) - DOST	NanoLab, Material Science Division (MSD)				
Academe					
Ateneo de Davao University (AdDU)	Chemistry Analytical and Research Laboratory				
Ateneo de Manila University (AdMU)	Nanotechnology Laboratory				
De La Salle University (DLSU)	iNano Research and Solid State Physics Lab				
De La Salle University (DLSU)	Central Instrumentation Facility				
Institute of Chemistry, University of the Philippines (UP) Diliman	Surface Science and Spectroscopy Laser Lab, Analytical Services Lab				
UPLB Nanotechnology Program, University of the Philippines Los Baños	UPLB NanoScience and Technology Facility Analytical and Instrumentation Service Laboratory (UPLB NanoLab)				
University of Santo Tomas (UST)	Research Center for the Natural and Applied Sciences Analytical Services Laboratory				
Private Institutions					
D&L Industries, Inc.	DLI- Analytical Laboratory				
NASAT LABS	Nanotech Analytical Services and Training Corp.				
Southeast Asian Fisheries Development Center (SEAFDEC) – Aquaculture Department	Laboratory Facilities for Advanced Aquaculture Technologies				

Philippine Nanomaterial Testing Laboratories

ENVIRONMENTAL, HEALTH AND SAFETY RESEARCH IN THE RISK ASSESSMENT OF NANOMATERIALS

Project Leader(Phase 1):
Blessie A. Basilia, PhD

Project Leader(Phase 2):
Josefina R. Celorico, RCh

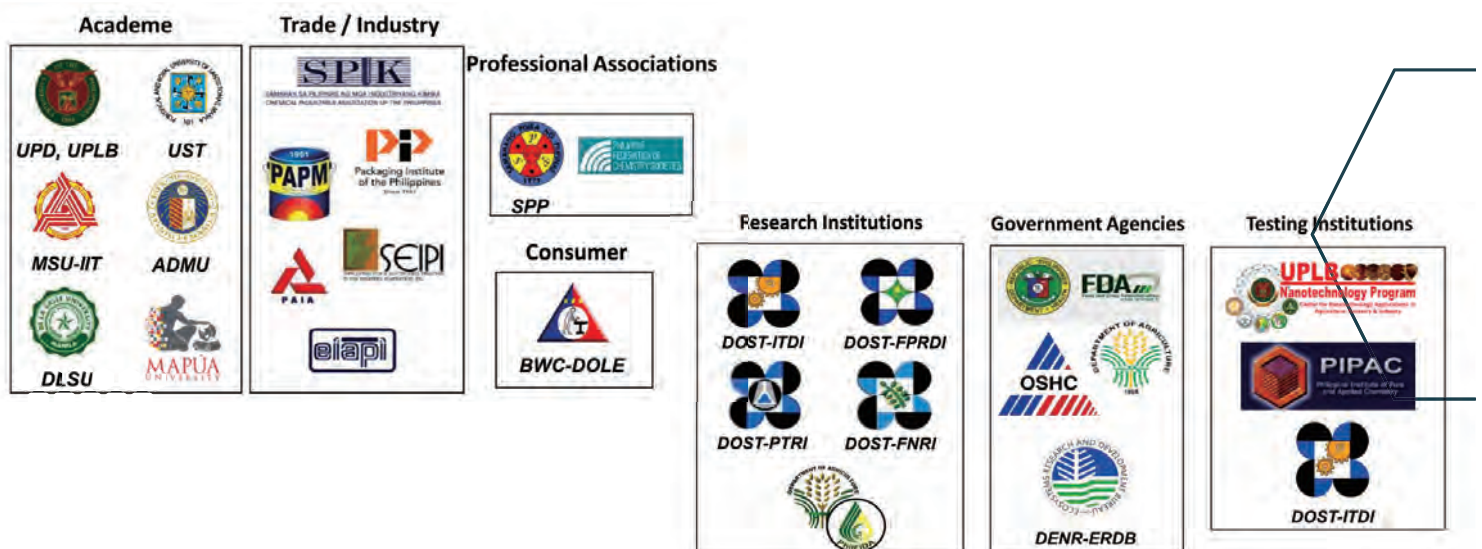


ENVIRONMENTAL, HEALTH AND SAFETY RESEARCH IN THE RISK ASSESSMENT OF NANOMATERIALS



1. To establish capability on the assessment of nanomaterials in terms of safety
2. To gather primary safety data for nanomaterials in the Philippines(R&D)
3. To review and assess the testing manuals on nanotechnology based on existing international standards, protocols and guidelines of the International Organization for Standardization (ISO)

Established Bureau of Philippine Standard-Technical Committee-85(BPS/TC-85) Nanotechnology





Philippines as
(P-member) to ISO/TC 229
on Nanotechnologies

BPS/TC-85 ON NANOTECHNOLOGIES



**PARENT
COMMITTEE**



SC 1

Measurement and
Characterization



SC 2

Health, Safety and
Environmental
Aspects of
Nanotechnologies



SC 3

Material
Specifications



BPS/TC-85 ON NANOTECHNOLOGIES

70

PHILIPPINE NATIONAL STANDARDS
ON NANOTECHNOLOGY
PUBLISHED



BPS/TC 85 Nanotechnologies

Published Standards	2019	2020	2021	2022
SC-1: Measurement and Characterization	4	4	10	7
SC-2: Health, Safety and Environmental Aspects of Nanotechnologies	2	6	13	6
SC-3: Material Specifications	4		9	5



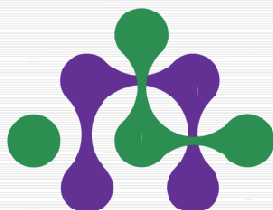
MARAMING SALAMAT PO!

PERSIA ADA N. de YRO, PhD

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Department of Science and technology
DOST Compound, Gen. Santos Ave.
Bicutan, Taguig City, Philippines



I.R.I



Iran Laboratory Network

LabsNet



Common challenges in providing laboratory services

- ❖ Scarce financial resources and unlimited demands for high-tech lab equipment;
- ❖ Considerable costs of laboratory establishment;
- ❖ The difficulty of finding and accessing laboratories which provide required services;
- ❖ The need for standardized laboratories to develop high-tech products;
- ❖ Lack of skilled equipment operators.





The results of a survey in Iran in 2003



Iran High-Tech Laboratory Network (LabsNet)

Not accessible integrated and comprehensive data-bank

Out of service lab instruments



Low productivity of the research facilities

Not well-trained laboratory staff

and so on ...



Networking **or** Not Working



Sharing infrastructures and capabilities through a network





Laboratory Network Development



NANOLAB:

- Nanotechnology Labs
- 84 lab members

LABSNET:

- All fields
- Over 1500 lab complexes

2004

2014



LABSNET® Statistics



LabsNet

1500 laboratory complexes
(in 152 cities throughout the country)

+ 3 million services per year

+ 30,000 equipment

+ 10,000 Laboratory Staff

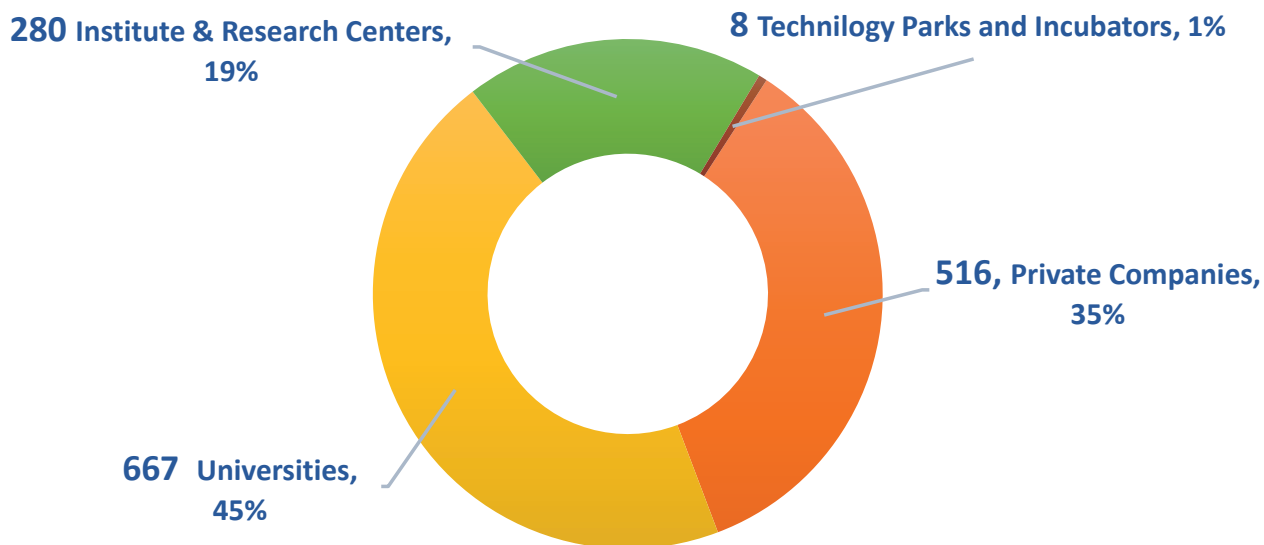




LABSNET® Organizational Diversity of Members



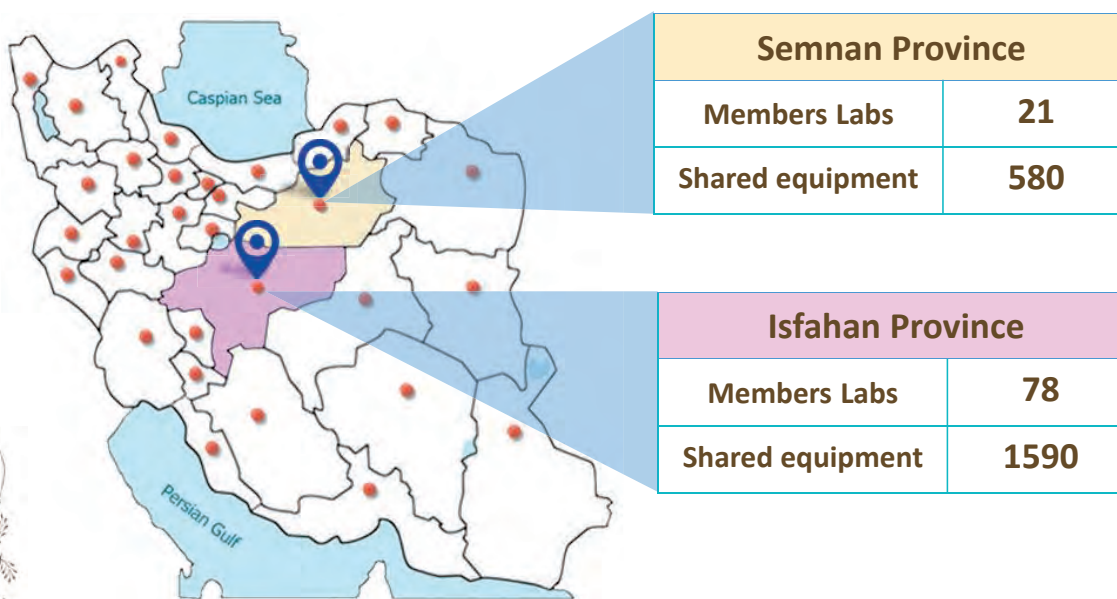
Iran High-Tech Laboratory Network (LabsNet)



Some Examples of LABSNET® information accessibilities



Iran High-Tech Laboratory Network (LabsNet)



[Searching....](#)

- Laboratories
- Equipment
- Tests
- Standards
- Products



Some of the LABSNET® Members



Iran High-Tech Laboratory Network (LabsNet)



LABSNET®, A platform for knowledge sharing



Iran High-Tech Laboratory Network (LabsNet)

Developing
16 national
standards

+2700
Experts

Social Network

Joint Publication
(5 Books – 170 Papers)

Workshops

LABSNET WGs:

TEM	SEM	SPM	BET	Analysis	X-Ray	NMR	PSA
Standard & Calibration		Chromatography		Spectroscopy		Biotechnology	





Journal of Laboratory Knowledge



Iran High-Tech Laboratory Network (LabsNet)



Published Since 2013 Seasonally



LABSNET® Networking Programs



Iran High-Tech Laboratory Network (LabsNet)





LABSNET® support schemes

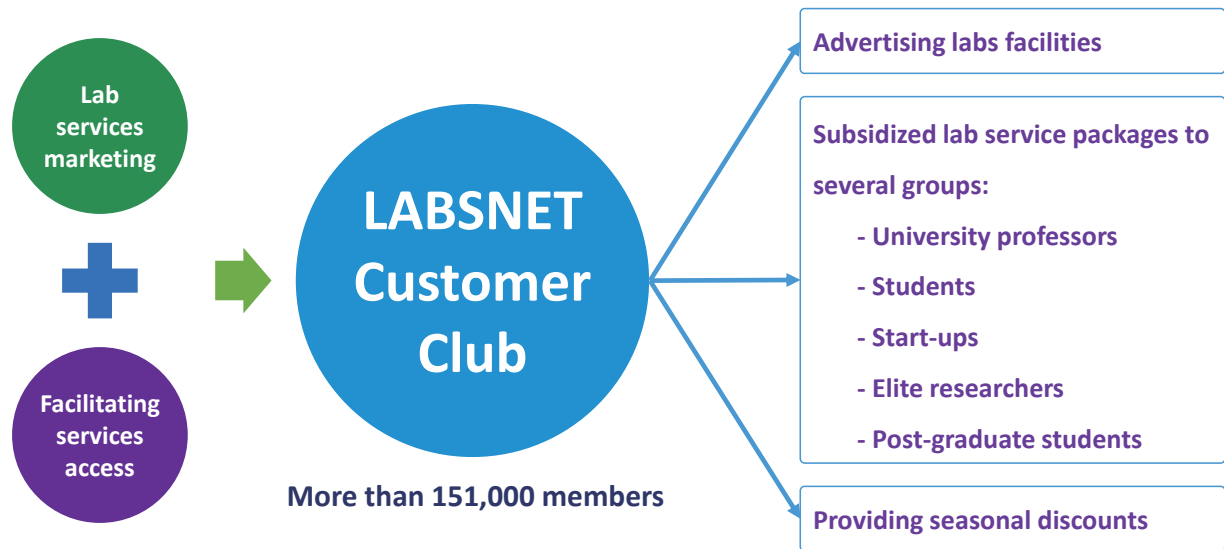


LABSNET® members activities evaluation





LABSNET® customer club



LABSNET® International Partnerships



LabsNet welcomes a variety of international collaborations in:

- ❖ Laboratory services (test and measurement);
- ❖ Specialized training courses;
- ❖ Interlaboratory comparisons;
- ❖ Consultation on implementation and training laboratory standards;
- ❖ Networking laboratories (organizational, national, regional, union members, etc.)

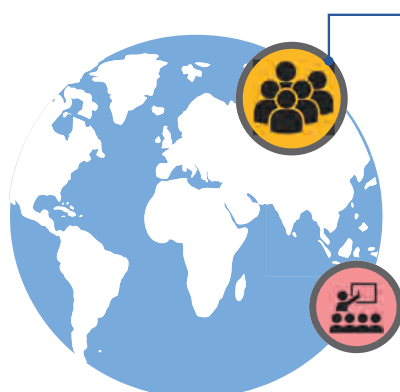
and other projects of mutual interest.



LABSNET® International Collaboration



Iran High-Tech Laboratory Network (LabsNet)



7 Countries



Turkey



Pakistan



India



Malaysia



Bangladesh



Indonesia



Mozambique

International Webinars



www.intlabsnet.com



LABSNET® International Workshops



Iran High-Tech Laboratory Network (LabsNet)

COVID-19



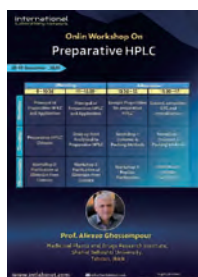
Biotechnology



1st FOOD



HPLC



COVID-Vaccine



2nd FOOD



3rd FOOD





Thank you for your
kind attention.



www.Labsnet.ir