
Nano and Advanced Materials Institute Limited (NAMI) – The Global Technology Marketplace

Think Asia, Think Hong Kong

NY / LA

11th and 14th June, 2013

Ka Ming NG
CEO, NAMI
Chair Prof, HKUST



納米及先進材料研發院有限公司

Nano and Advanced Materials Institute Limited

NAMI's Goals

- Serve Hong Kong and Mainland industries in collaboration with the global community in technology development and commercialization
- Fill the gap between fundamental research and commercial production – applied research and pilot testing

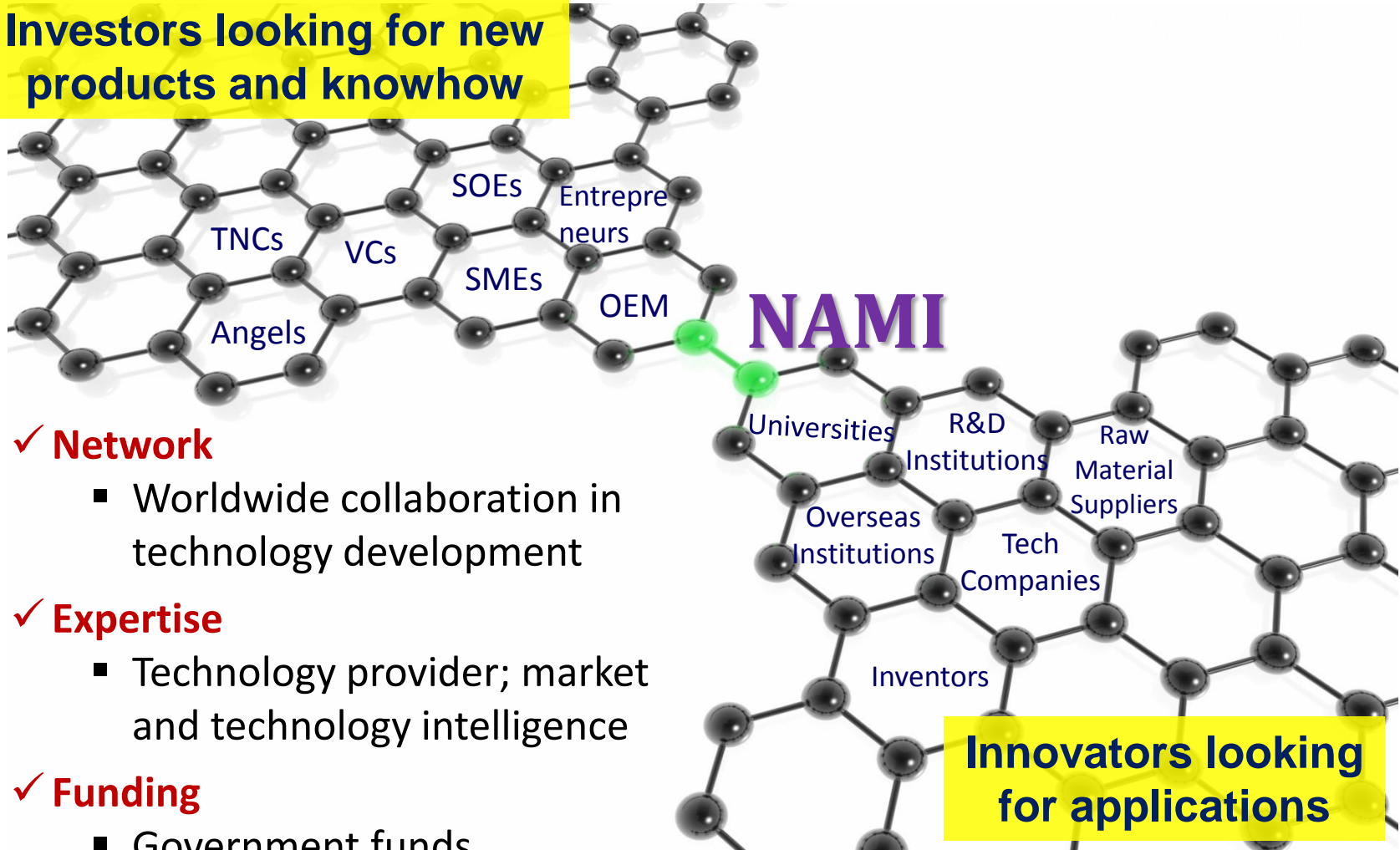


納米及先進材料研發院有限公司
Nano and Advanced Materials Institute Limited

Confluence of Innovations

Our Approach and Strategy

Investors looking for new products and knowhow



✓ Network

- Worldwide collaboration in technology development

✓ Expertise

- Technology provider; market and technology intelligence

✓ Funding

- Government funds
- Private and institutional funds



納米及先進材料研發院有限公司
Nano and Advanced Materials Institute Limited

Confluence of Innovations

Strong External Support and Network

Technical Affiliates

Solar Energy Experts



Construction Materials Experts



Business & Industry Affiliates



InvestHK
The Government of the Hong Kong
Special Administrative Region



香港工業總會
FHKI Federation of
Hong Kong Industries



Hong Kong 香港科技園
Science & Technology Parks



香港中華廠商聯合會
The Chinese Manufacturers' Association of Hong Kong



international zinc association



香港醫療及保健器材行業協會
Hong Kong Medical and Healthcare Device Industries Association



STANFORD
UNIVERSITY



華南理工大學



VC2

Value Creation Center



香港電子業商會

The Hong Kong Electronic Industries Association

INTELLECTUAL VENTURES



HKIE THE HONG KONG
INSTITUTION OF ENGINEERS
香港工程師學會
Electronics Division, Environmental Division and Materials Division
電子分部、環境分部及材料分部



香港電器製造業協會
HONG KONG ELECTRICAL APPLIANCES
MANUFACTURERS ASSOCIATION

HK Science Park

Office space: 8,415 sq.ft.



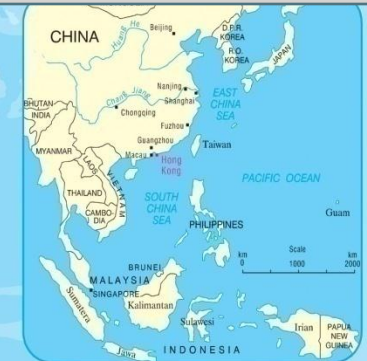
Lab space: 14,144 sq.ft.




NAMI's Facilities



HKUST #1 in Asia



NAMI's Five Areas of Focus



**Construction
Materials**



**Sustainable
Energy**



**Environmental
Technologies**



**Display & Solid
State Lighting**



**Bio & Healthcare
Products**

Case 1: Collaboration with DuPont on Thin Film a-Si



Confluence of Innovations

Case 2: Collaboration with HP on SERS



Overview of HP's Surface-Enhanced Raman Spectroscopy (SERS) and the potential of technology realization

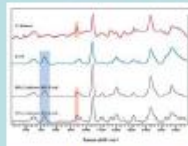
SERS Background

Laser excitation of these roughened metal nanostructures resonantly drives the surface charges creating a highly localized (plasmonic) light field. When a molecule is adsorbed or lies close to the enhanced field at the surface, a large enhancement in the Raman signal can be observed.



SERS is finding increasing use in a variety of applications ranging from:

1. Environmental safety - Contaminants detection in water, air, etc.
2. Food safety - Toxins, pesticides, E-coli, etc.
3. Medical diagnostics - Disease markers, pathogens detection, drug development and health monitoring
4. Authentication - 'Chemical bar code' reading for anti-counterfeiting
5. Industrial chemical monitoring - Hazard chemical detection
6. Security/law enforcement - illicit drugs and explosives detection
7. Discovery - New exploratory research (oil and gas)

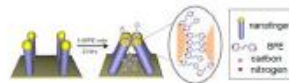


SERS Advantages

1. Molecular fingerprinting - Unique vibrational spectra distinguish molecules
2. Tagless Monitoring - Fluorescence labeling is not needed
3. Multiplexed sensing - Plasmon resonance allow for sensor reusability
4. In vivo applicability - Near-IR excitation and biocompatibility allow
5. Post-sensor and beyond - Single molecule spectroscopy is possible

Working Mechanism of HP's SERS

- Gold-coated nanoscale polymer fingers made by nanoimprinting technique
- After the arrays were exposed to analyte solutions and air-dried, the fingers closed together in groups of four. These structures can provide a generic platform for molecule trapping and SERS sensing with high sensitivity and uniformity
- If molecules all between the fingertips, they are the primary factor that determines the gap size between plasmonic structures
- The finger closure is driven by capillary forces during the liquid drying step. As the solvent evaporates from the array, neighboring fingers are pulled toward each other while the analyte molecules are wicked up the fingers and trapped between the fingertips after the evaporation is complete.



Comparison of SERS Technologies

	HP	Seoul National University, NanoBio Fusion Research Center	Real Time Analyzers	Kiaitec
Source	Gold Nanofingers for Molecule Trapping and Detection, J. Am. Chem. Soc. 2010, 132, 12800-12822	Highly uniform and reproducible surface-enhanced Raman scattering from DNA-tetrahedral nanoparticles with 1-nm interior gap, nature nanotechnology, vol 6, July 2011	Product: Chemical Residue Detector Patents: Detectort	Resistive Diagonl cs Ltd.
Active Surface	Gold Nanofingers closed together in groups of four to provide a generic platform for molecule trapping	Gold nanobridged nanogap particles (Au-NBP)	Metal-doped sol-gel material	Gold coated nano-structured silicon
Advantages	Reproducible and uniform response	Reproducible and uniform response		
Gap Size	Molecule size (Å)	1nm		
Enhancement Factor (EF)	2x10 ¹⁰	1x10 ⁸ to 5x10 ⁹	10 ⁷	10 ⁷ to 10 ⁸

HP's latest development



Advantages of HP SERS

- Accurate molecule fingerprinting** - Good for trace detection
- Non-destructive** - No sample preparation is needed
- Highly sensitive to single molecule** - Enhancement factor - 2x10¹⁰
- Real time response** - Rapid test in seconds
- Convenient to use with portable reader** - Consumer electronic and domestic like
- Low cost** - Lower cost than desktop device

Development Roadmap



Potential Applications of the SERS Technology

Sensors for the detection of Melamine in milk products

At present, around 15% of milk products, originating from China, are shown to contain melamine in excess of 2.5 mg/kg (the WHO limit)

Trace detection of illegal drug and explosive

e.g. Cocaine, Ketamine, Heroin

No such handheld device can be found in the market
Detection sample form: Gas particles in ppb level

Medical diagnostic by rapid detection of pathogen

In vivo SERS imaging of unique or rare cancer cells

Sensors for the detection of Phthalizers (phthalate) in bottled water / drinks and foods

WHO, EU recommend no more than 0.025ppm per day per person intake
Currently no rapid test for phthalizers

For additional information please contact:
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Five Types of Projects

- **Platform research projects**
 - At least 2 industrial partners
 - Industry cash / in-kind contributions at least 10% of the total project cost (IP owned by NAMI)
 - **Collaborative research projects**
 - Industry cash/ in-kind contribution is no less than 50% of the total project cost (IP owned by company)
 - **Contract research projects** (solely funded by industry)
 - **Seed Projects** (solely funded by NAMI)
 - **Trade Association Projects** (NAMI responsible for soliciting funding; forward-looking and beneficial to entire market sector)
- **Cash rebate for R&D** (30% of industrial contribution)
- *Up to half of the total project fund can be spent outside of Hong Kong.*



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