

# Nanotechnology Networking: ITRI's Approaches

Jih Chang Yang

Industrial Technology Research Institute

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# Industrializing Nanotechnology in Taiwan

*Blue/Italicized are ITRI clients  
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## IC

- *TSMC ( MRAM, FinFET)*
- *NA Co. ( MRAM)*
- *Eternal Chemical, YK, SL Tech (CMP slurries)*

## PCB

- *NA Co. (Epoxy/Clay composites)*
- *KC Co. (Planarized substrates)*
- *KT Hitech (Flexible substrates)*

## Biomedical

- TTY Biopharm (Liposomal medicine)
- Formosa Kingstone bioproducts(nanosize Chinewe herbal medicines)
- President (High calcium,iron nanoparticle milk)
- High DNA (High DNA healthy food)
- *CYCo.* (Biochips, microfluidic undulator)
- Apex Bio (gold nanoparticle, microelement in nanosize)
- GN Co. (Nano-gold, trace elements)
- YH Tech (刮砂板)
- Jing Wang (Nanohigh energy bioproduct)
- Asiagene (DNA labeling)
- Butyshop (nanotech skin care products)
- *Green Shield* (Lottech patch;Pimple patch)

## Textiles

- FE、CH、LL、CGF(Anti-bacteria, odor, UV fibers)
- China Petrochemical (Functional nano nylon fibers)
- YTS Co.(Nano masks)
- YH Tech(Nano sports wear, swim wear, beddings, stockings)

## Nanomaterials

- *PK Nanotech* (Nano-clay)
- *HC Paints* (30nm nano-pigments , TiO<sub>2</sub> nano photocatalysts)
- *New MK* (nano-pigments)
- YK (Anti-reflection glass)
- *TECO (Carbon nanotubes)*
- *F Co.*(Nano-powder)
- *BM Co.* (Nano-powder)
- *YHS Co.* (Nanoparticles,1000g/hr)
- *CT2 Co.* (TiO<sub>2</sub>, Ag ions)
- *FTI、HK、NA、NB、CL、NT Co.* (Nano clay composites)
- *Great Eastern Resins* (Nano SAN/clay composite)
- MK (Nano rubber composites)
- *LH Co.* (Heat conducting rubber)
- *CT Co.* (UV absorption emulsions)
- *Eternal Chemical* (PDA surface treatment chem.)
- CC Co. (Nano plastic materials)
- *HT Co.* (Nano metal catalysts)
- *TY Co.* (Magnetic fluids)
- *FY Tech.* (LTCC)
- HC Co. (Dielectric powders)
- *WB Co.* (self-assembled nanomaterials)
- *CHF Co. , WM Co.* (Nano starch)
- KS Biotech(Biodegradable packing mat.)

## Building/Construction/Appliances

- *TOTO* (Anti-bacteria tiles)
- HC Co. (Bath, toiletry products)
- TF Co. (Nano-photocatalytic lighting)
- Tatung、Sharp、Sanyo (Air cleaners)
- HF Industry(Ceramic surface treatment)
- *TECO* (Nanomaterial refrigerators)

## Displays / Computers

- *TECO、 YD Co.* (CNT-FED)
- RiTdisplay、 *TECO* (OLED)
- Delta (PLED; CNT-LED, Outdoor Displays)
- *YK Paints* (LCD color filters)
- JP (self cleaning notebook casings)

## Optoelectronics

- *SC Paints, NA, TH, FT2 Co.* (Nano-ink for ink jet printers)
- *TS Co.* (Organic photoconductors)
- *YH* (30 nm high purity photoconducting material)
- *LY Co.* (ARMI recordable CDs)

## Energy

- *Koin Chemical* (battery separators)
- *TY Co.* (Energy storage nano materials)
- *HT Co.* (Fuel cell nano catalysts)

## Instrumentation/Diagnostics

- *LC Co.* (Nano MW plasma)
- *TC Co.* (Nano diagnostic equip.)
- MK Tech (Testing/diagnostics)

## Sporting Goods

- KINIK (Golf club heads、 nano diamond coating)



## Is Nanotechnology ...

- a **revolutionizing force** that turns existing industries upside down through a “molecules everywhere” transformation?
- or more of a powerful **enabling force** that mainly pushes existing industries to new heights and engenders great competitive advantages for its vigilant adopters?



# There are Three Kinds of Nanotechnologies

- long-term grand visions (molecular machines, molecule-based computing, super drugs/treatments, biomimicry, etc.)
  - promises: revolutionary, transformational
  - problems: won't show up in the first trillions of dollars of nanotech market values
- **immediate applications (from textiles to metals to plastics to papers to toilets ...)**
  - promises: endless opportunities, majority of nanotechnology applications in the next 2 to 4 years
  - problems: low entry barriers, prone to commoditization, aiming too low
- **information industry applications (electronics, optoelectronics, displays, photonics, etc.)**
  - promises: dominant nanotechnology applications from 2005 to the foreseeable future
  - problems: fiercest competition all around



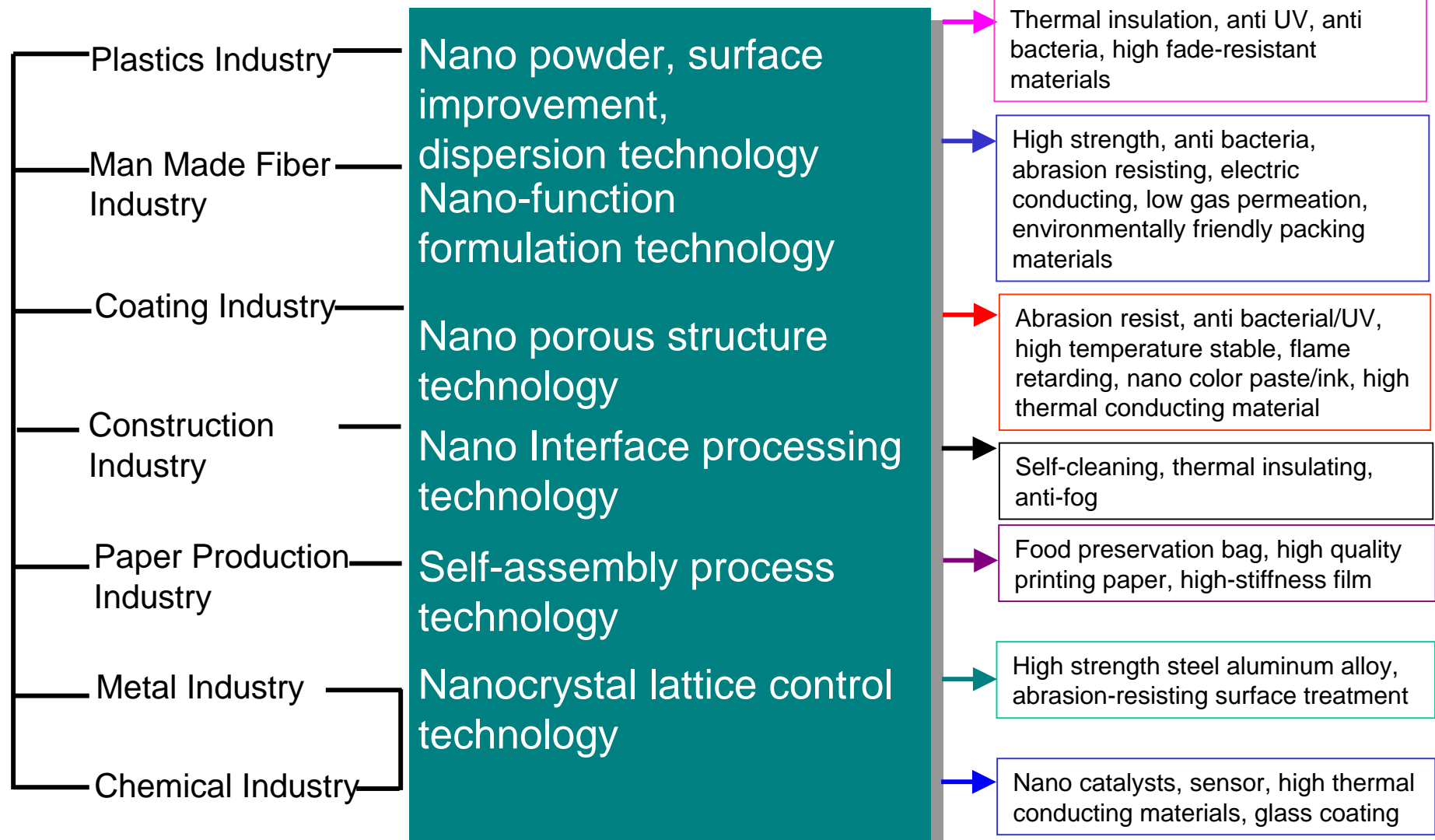
## Networking Hotspots: Major Information Industry Applications

- **nanoelectronics on CMOS**
  - nanomaterial technologies for CMOS-based IC fabrication from 90, 65 nanometers on down
  - non-volatile memories and other CMOS-compatible nanoelectronic devices
- **next generation displays**
  - CNT FED: large, high resolution, flat panel TVs at below CRT costs
  - flexible displays: versatile applications, low-cost roll-to-roll fabrication
  - organic TFT: electronics and displays everywhere
- **nanophotonic devices**
  - quantum dot devices: next generation lasers, light sources and displays
  - photonic crystal devices: reducing the size and cost of optical communications systems by 2 orders of magnitude
- **high-density storage**
  - optical and magnetic storage and read/write technologies to increase storage density to 25, 100 and 1,000 gigabyte (terabyte)
- **micro fuel cells**
  - high specific energy, thin, flat, room-temperature micro fuel cells to replace batteries for mobile 3C products – 12 hours for notebook computers, 50 days for cell phones, etc.

# Networking Hotspots: Traditional Industry Applications

## Enabling Nanotechnologies

## Innovative Product





## Networking Hotspots: Frontier “Competencies”

- surface plasmon resonance
- nano-patterning
- nano-imprinting
- gate dielectric and high mobility materials
- supramolecular materials
- hyperbranched materials
- photonic materials
- etc.





# Nanotechnology Networking at ITRI

- **industry**
  - industry consortia: semiconductors, optoelectronics, textiles, specialty chemicals, pigments and paints, etc.
  - technology consortia: micro fuel cells, displays materials, storage, carbon nanomaterials, etc.
  - Nano-powder Service Center
  - instrumentation and diagnostics alliance
  - Nano-express Newsletters
- **academia**
  - joint laboratories: leading universities
  - joint-appointment PIs: cutting-edge “competency” development
- **international**
  - Nano-excellence Program: long-term collaboration with targeted specialists of the world
  - Visiting Researchers Program: exchanges with centers of excellence around the world





# International Networking

Joint Project	Ca NRC/NSC	US Arizona (ODSC)/ITRI US Carnegie Mellon(DSSC) /ITRI US Rochester Optics Center/ITRI Jp Tohoku U./ITRI, AIST/ITRI/NTU, Northeastern Univ./ITRI, AIST/ITRI	Terabyte Data Storage
Nanoparticle, Nanostructure	De Tech. U. of Berlin Ru IPCP/ITRI Ru Ioffe/ITRI Jp AIST/ITRI US MIT/ITRI US NW Univ./ITRI De INM/ITRI De Fraunhofer-ISC/ITRI	Jp Northeastern Univ./ITRI NL Delft Univ. (SET) /ITRI US Harvard Univ. /ITRI (CNT Devices) Ukraine Kiev Univ. /ITRI (Quantum Devices)	Nano Electronics
Nano Template Material	Ru Ioffe/ITRI		
Nano Magnetic Material	Jp Veeco, Ulvac, Anelva Tegal/ITRI Jp SNCT /ITRI	US NW Univ./ITRI	Nanophotonics
Nanotubes	US NW Univ./ITRI Ru IPCP/ITRI Jp NEC/ITRI Jp AIST/ITRI US UCLA/ITRI	DE Kaiserslautern Univ./ITRI US NIST/ITRI	Characterization of Nano Material
Nanobiotechnology	Jp Tech. Alliance/ITRI	US NIST/ITRI	Metrology



# Significance of Nanotechnology Networking

- never was an R&D topic so vigorously pursued by all of the technologically significant countries of the world, and the coming global marketplace battles will be some of the fiercest ever
- strategic networking and partnering will be crucial to the success of any marketplace-driven nanotechnology research program
- there will be three kinds of networking activities
  - for research collaboration: to accelerate R&D
  - for technology dissemination: to commercialize technology
  - for strategic alliances: to gain marketplace upper-hands