Transatlantic Workshop on Nanotechnology Innovation and Policy

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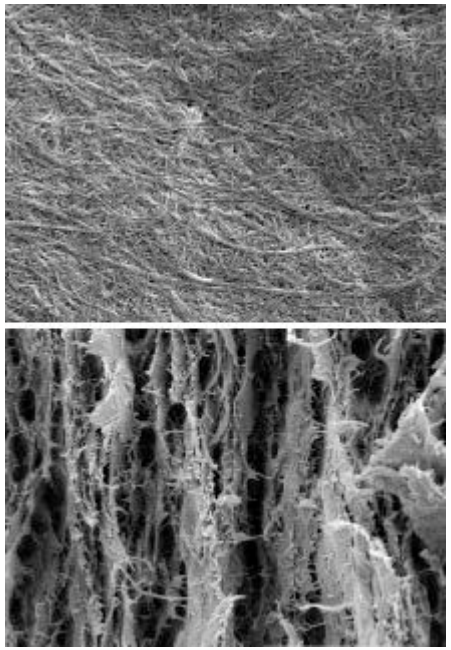
Commercialization of nanotechnology

- Corporate entry through to mid 2008*
  - 18,000 unique companies entering nanotechnology (worldwide, 1990-2008)
    - 52,000 nanotechnology articles published
    - 42,000 patent applications
    - 17,000 patent awards
- Products on the marketplace
  - Consumer products (PEN)
    - 212 products identified in March 2006.
    - 1000+ products in 2009
  - Numerous other applications in the nanotechnology value-chain
    - Nanomaterials, nanoelectronics
- Devices and systems in corporate development
  - Expansions of existing applications
  - New applications involving more complex active nanostructures
    - including targeted drugs and chemicals, energy storage devices, nanoelectromechanical, and nanobio devices

* Philip Shapira, Jan Youtie, Luciano Kay Corporate Entry into Nanotechnology through Patents and Publications: 1990 to 2008, Georgia Tech Program in Science, Technology, and Innovation Policy, Atlanta, February 2010. Patent data from Patstat .

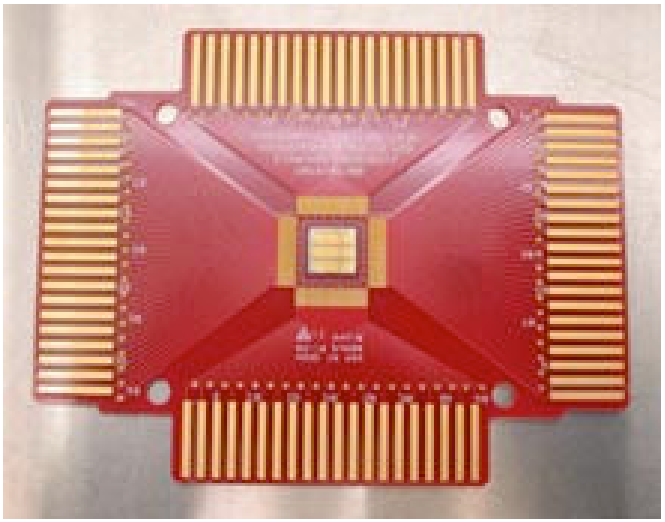
Repackaging
Nano packaging and smart paper



Paper gets tough: An entangled film of 10-to-40-nanometer-thick cellulose fibers makes strong, tough nanopaper that could be used in medical implants and vehicle parts. A cross section of a fracture surface in the paper shows layers of cellulose fibers.
Credit: American Chemical Society

- Clay Nanoparticles to Improve Plastic Packaging for Food Products (Bayer: Durethan)
- Embedded Sensors in Food Packaging and 'Electronic Tongue' Technology (Kraft)
- Nanopaper with strength of iron, properties – cellulose nanofibers infused with CNT, graphene (RIT, Sweden)

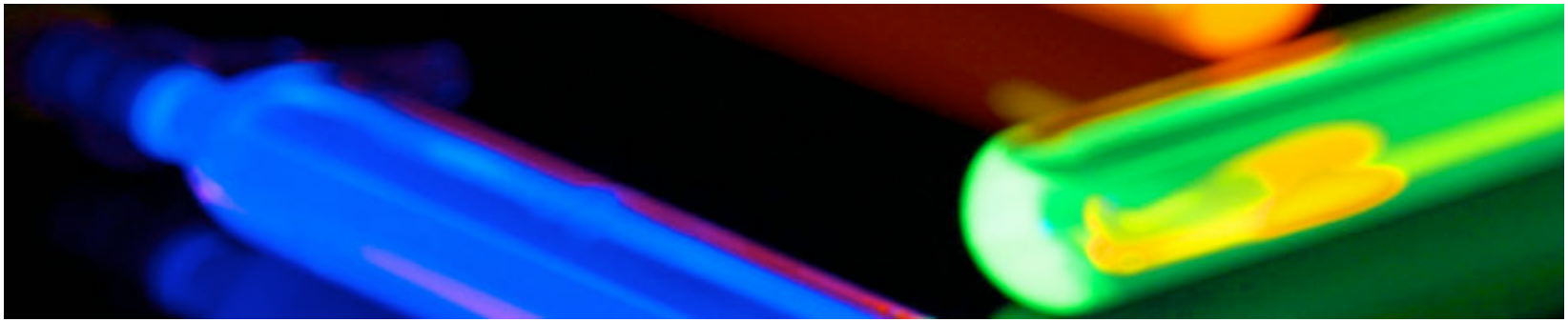
More efficient, nano-enabled solar cells

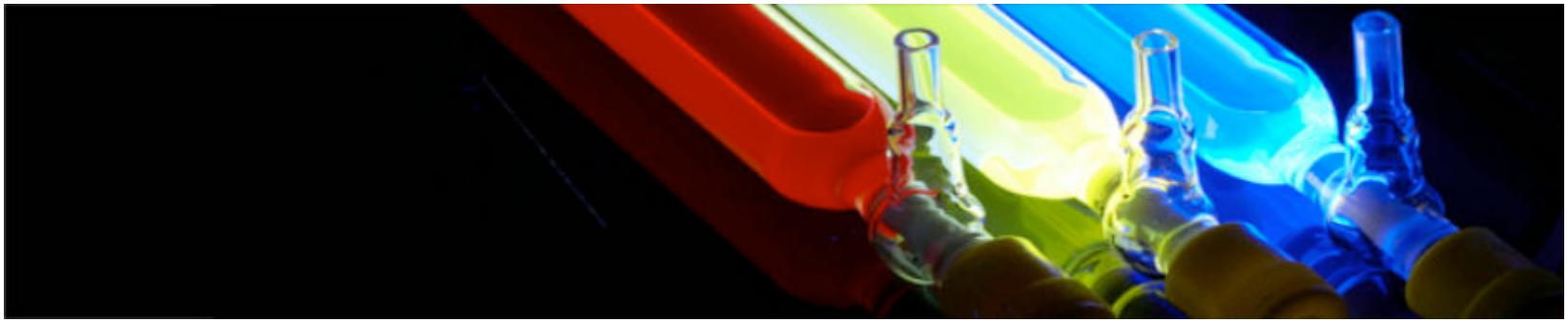


Source: Technology Review

Increasing solar cell efficiency
- solar cells with coating that contains metallic nanoantennas tuned to the solar spectrum.
- redirects light, increases absorption
- Broadband Solar (CA); First Solar (AZ)

Semiconductor nanoparticles “quantum dots”

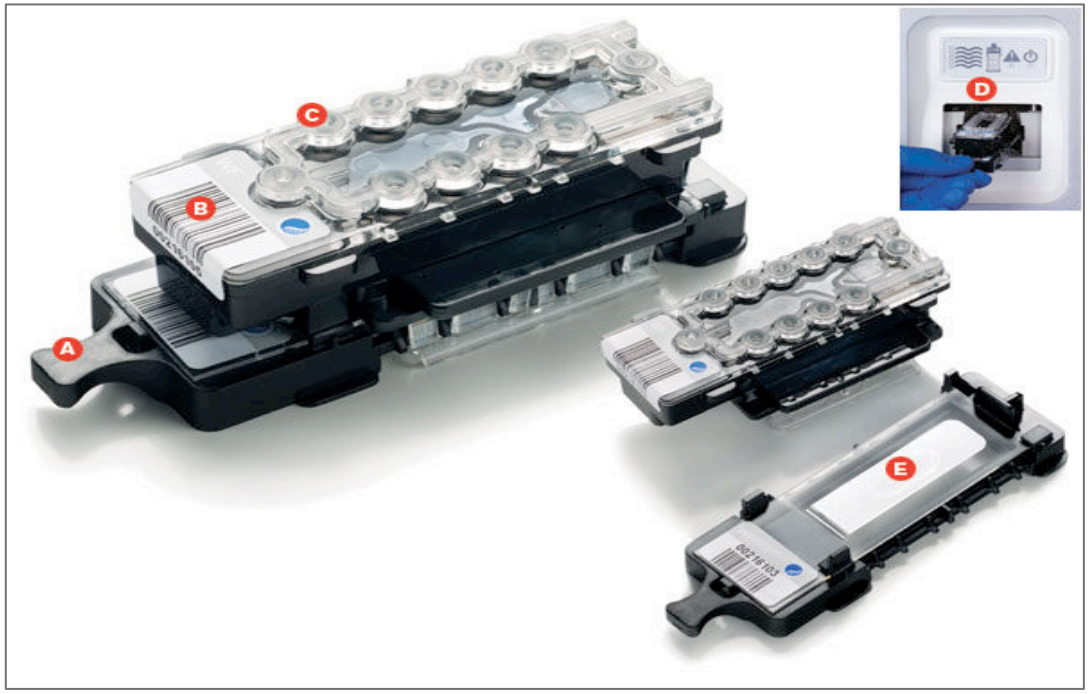




Source: Nanoco

QD platform technology: lighting; displays; medical; biological
- Small, fast leds, next generation displays, brighter, less energy
- Diagnostics (tagging), illuminating cancer cells
- Nanoco (Manchester, UK)

Verigine System (Nanosphere) Personalized Diagnostics on the Spot



Source: Technology Review

A few hours to analyze DNA
- Testing without sending to lab
- DNA is tagged by silver-coated gold nanoparticles
- Reader measures light scattered by tagged DNA
- Identifies sngle or multiple genetic targets

Workshop context

- **Nanotechnology promises to be a leading driver of future technology-based business and economic growth.**
  - Nanotechnology is already appearing in textiles, electronics, and other consumer and industrial products, and is expected to be increasingly used in medical, energy, and environmental applications.
  - The US and Europe, along with many countries elsewhere, are investing billions of dollars annually in nanotechnology development.
- **Many challenges to be addressed as nanotechnology moves out of the lab into widespread use, including**
  - Which companies and locations will lead in nanotechnology innovation?
  - How can potential risks can be addressed prior to commercialization?
  - Can nanotechnology innovation be focused to, and influenced by, societal needs and processes?
  - How should governance and policy for nanotechnology innovation evolve?
  - What are the opportunities for US-EU collaboration and leadership in nanotechnology policy and governance?

"Knowns" and "Unknowns" 1 of 2

"Knowns" (or better "knowns" especially in 2000s)

- Corporate entry into nanotechnology through research publications and patenting
- Geographical concentration of corporate entrants in nanotechnology
- Corporate linkages with public research and universities (formal)
- Venture capital funding for nano
- First generation consumer-oriented products

"Knowns" and "Unknowns"

"Unknowns" (or mostly "unknowns")

- Corporate strategy (in the face of uncertainty)
  - Cases
- Second+ generation nanotechnology products
- Influence of contrasting/emerging regulatory environments
- Consumer values and acceptability (esp. if nanoproducts are explicitly labeled)
- Emergence of global supply chains (and roles of MNCs v. "Born Global" SMEs)
- Take-up of nanotechnology by traditional industries
- Employment and labor market implications
  - How many "nano jobs" and where will they be located?
  - What jobs may be lost (creative destruction)?
- Ability of market-oriented commercialization to satisfy public values and goals for nanotechnology

Workshop Goals

- Address existing questions, raise new questions
- Share/improve methods, latest findings
- Engage junior and senior researchers
- Exchange perspectives from North America (US, Canada), Europe, Asia
- Outcomes:
  - New research questions & directions
  - Build collaborations
  - Publication and dissemination
    - Special Issue: Journal of Technology Transfer. All submissions will be peer-reviewed.

Sponsors and Partners

- European Union Center of Excellence (EUCE) at Georgia Institute of Technology
  - Viki Birchfield; Diane Alleva; Ansley Hynes
- Consulate General of Canada in Atlanta
- Center for Nanotechnology in Society (CNS-ASU)
- Georgia Tech School of Public Policy
- Georgia Tech Program in Science, Technology and Innovation Policy
- Manchester Institute of Innovation Research, University of Manchester.