

# **Where Does The Nano Go? Down the Drain**

**November 15, 2007**

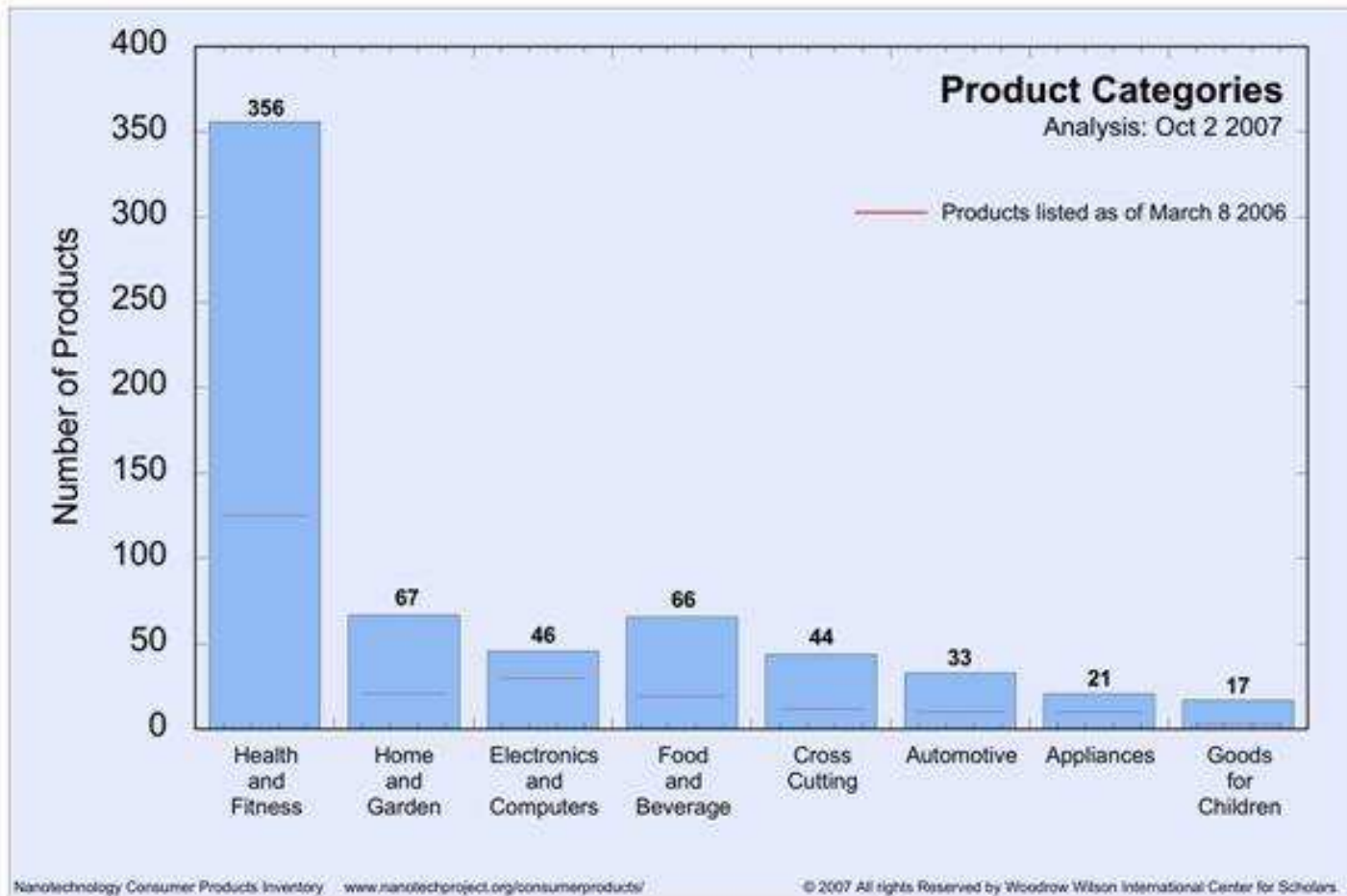
2007 National Pretreatment and  
Pollution Prevention Workshop

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# Nanotechnology Consumer Products Inventory

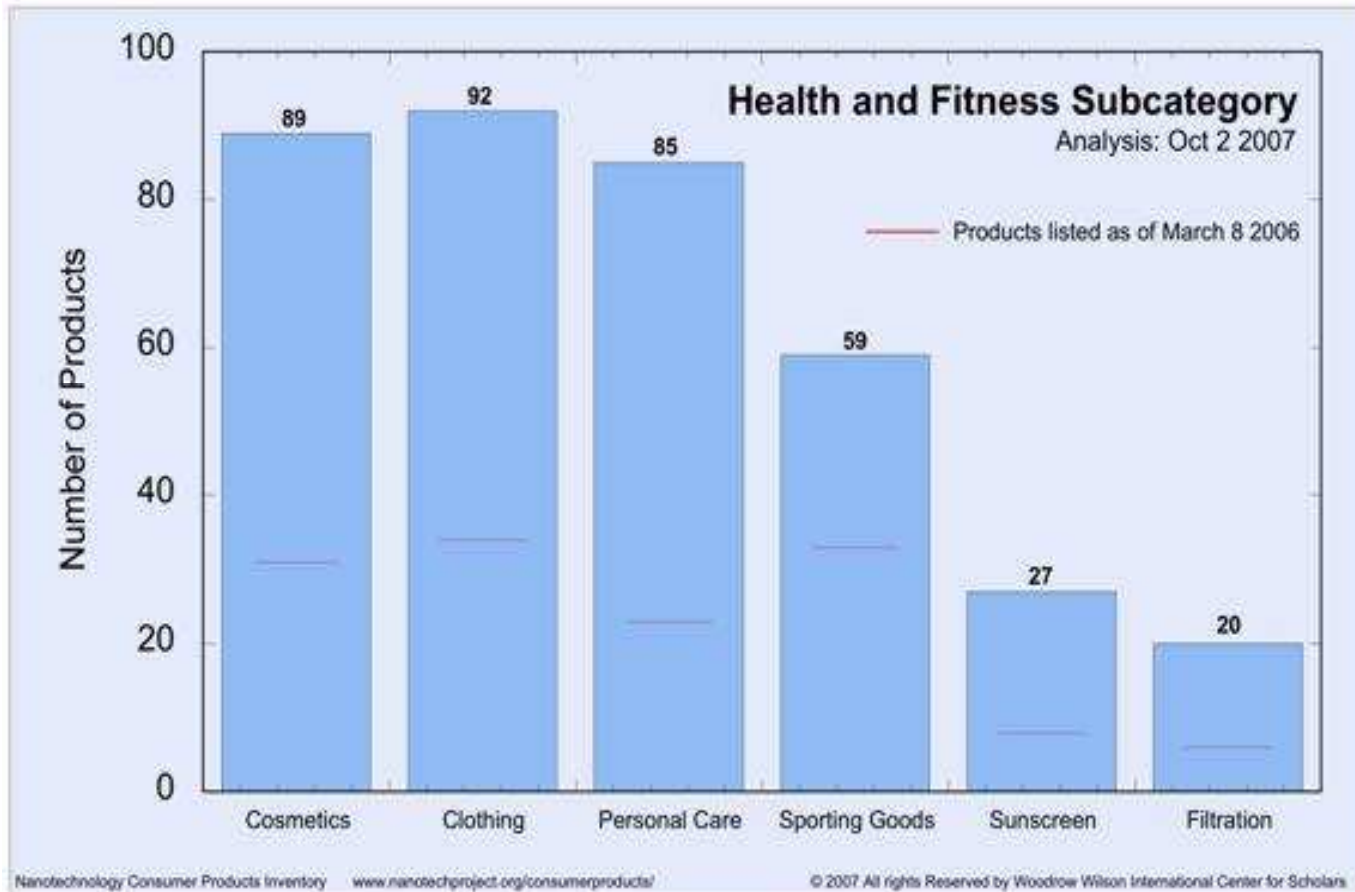


- 580 products on the market

- 356 are related to “health and fitness”

<http://www.nanotechproject.org/>

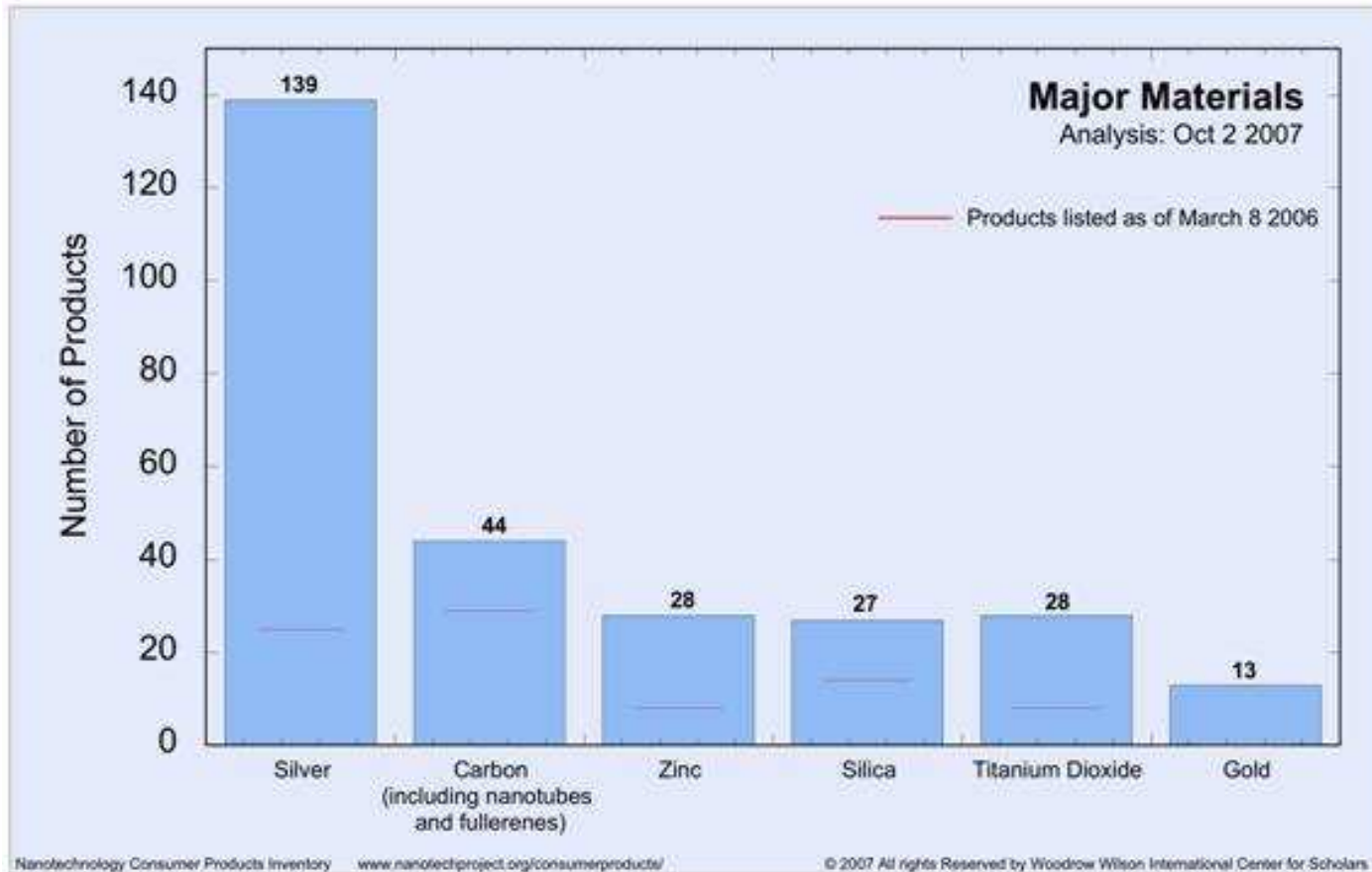
# Nanotechnology Consumer Products Inventory



1. **Clothing**
2. **Cosmetics**
3. **Personal Care** (e.g., toothpastes, shampoos, cleansers, pain relievers )

<http://www.nanotechproject.org/>

# Nanotechnology Consumer Products Inventory



- Majority of nano products contain silver

<http://www.nanotechproject.org/>

# Nanotechnology Consumer Products Inventory

- Juvena of Switzerland DNA Skin Optimizer, SPF 20, Cream
- “Juvena of Switzerland selected the absolutely best size for cosmetic skin care – 40 Nanometers. The Nano technology was chosen because it makes it possible to place the sensitive ingredients in the form of tiny crystals directly into the cell nucleus.”





# Nanotechnology Consumer Products Inventory



<http://www.dhccare.com/>

- Platinum Silver Nanocolloid Cream
- “This intensive, yet surprisingly light moisturizer helps minimize the appearance of wrinkles and age spots, thanks to absorptive platinum and silver nanocolloids”

# Nanotechnology Consumer Products Inventory

- Daewoo DWF-175MPS washing machine
- “Nano silver pulsator” releases nanosilver ions into the wash



<http://www.daewoo-electronics.de>

# Nanotechnology Consumer Products Inventory



fabric softener



oral supplement



aerosol cleaning spray



soap



## NANOVER Shampoo:

“using nanosilver technology, ingredients go into hair quickly and deeply, has [an] outstanding moisturizing and dandruff removing effect.”



# Why address Nanotechnology End-of-Life Issues?

- Little is known about effects of nanomaterials and nanowastes on human health or the environment
- Nanomaterials may behave differently in the environment than bulk materials
- No law deals specifically with nanotechnology

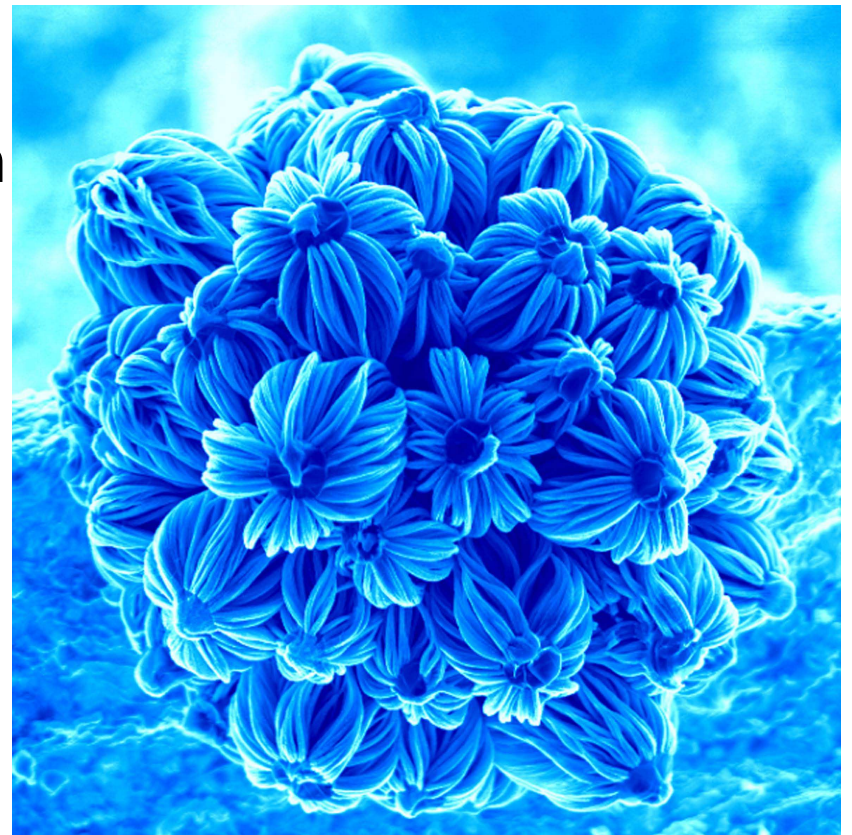



Photo courtesy of Ghim Wei Ho and Prof. Mark Welland




# **How Does the Law Deal with Nanowastes?**

- All major federal environmental laws are sufficiently flexible to cover nanowastes
  - FIFRA is only law EPA has applied to a nanomaterial to date (Washing machine)
  - TSCA is primary focus of current debate
  - No state laws regulate environmental effects of nanomaterials
- 




# **Does CWA cover Nanowastes?**

- Nanowastes likely are “pollutants”
  - No nanowastes are currently covered as pollutants solely due to their size
  - Many nanowastes may be considered pollutants in their macro form
  - EPA has made no determinations with respect to nanowastes under the CWA
- 



# Does CWA cover Nanowastes?

- EPA has the authority to regulate nanoparticles discharged from a point source, including discharges to a POTW.
    - §§ 301, 307 - Technology-Based Effluent Limitations
      - Further research necessary to determine the best available technologies that are economically feasible for regulated entities; and to develop appropriate control technologies.
    - § 302 Water Quality Based Effluent Limitations
      - Further research is necessary to determine whether nanoparticles have a potential adverse effect on human health or the environment
  - Any meaningful regulation would require development of technologies for accurately monitoring, measuring, and controlling nanoparticles.
- 



# RCRA and CERCLA

- ELI used two hypothetical scenarios to explore how nanowastes could be regulated under two federal laws intended to deal with wastes:
  - Resource Conservation and Recovery Act (RCRA)
    - Regulates handling, reuse, recycling, storage, treatment, and disposal of solid wastes, including hazardous wastes
  - Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or the Superfund law)
    - Addresses hazardous substance contamination and disposal issues not addressed through RCRA and other laws
      - Inactive or abandoned hazardous waste sites







# Does RCRA Cover Nanowastes?

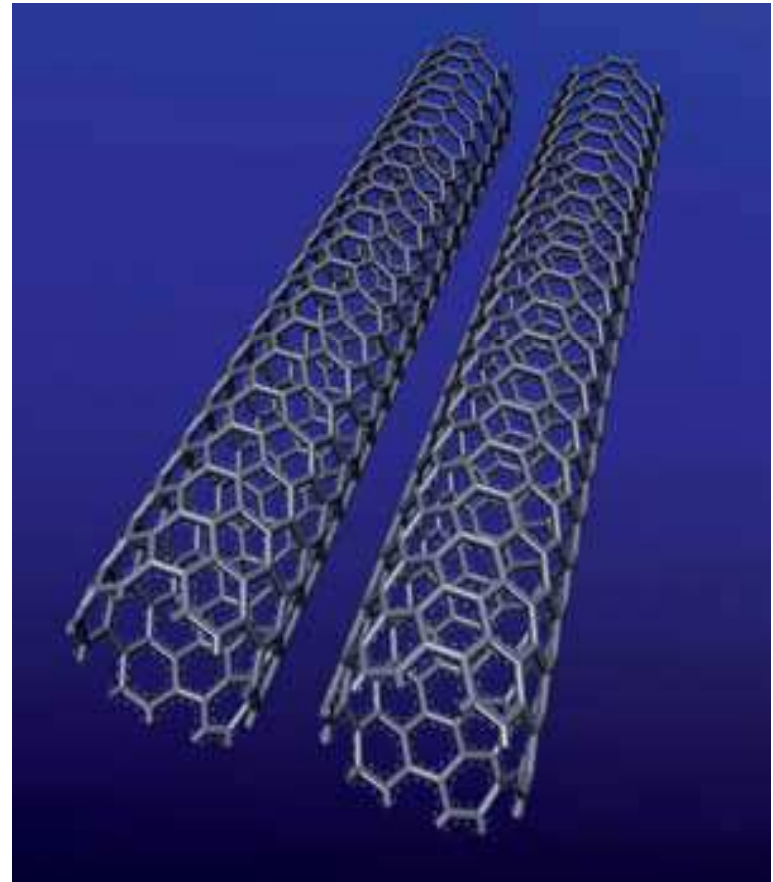
**Yes, in theory.**

- **Some nanomaterials likely will be classified as hazardous wastes under the existing rules**
- **Listed wastes**
- **Characteristic wastes**
  - Corrosivity
  - Ignitability
  - Reactivity
  - Toxicity (Toxicity Characteristic Leaching Procedure)



# Does RCRA Cover Nanowastes?

- Focus of RCRA on mass as a determinant of regulatory coverage may not be appropriate for nanowastes
- Disposal of most consumer products containing nanomaterials will likely be exempt from RCRA as household waste



Nanotubes. Photo courtesy of Friends of the Earth, 2007



# **Key Issues in Applying RCRA to Nanomaterials**

- RCRA
  - Is the substance in question a solid waste?
    - Discarded – abandoned, recycled, or inherently waste-like
  - If so, is the substance a hazardous waste?



# RCRA and Nanowastes




Photo courtesy of Ghim Wei Ho and Prof. Mark Welland

- Wastewater sludge could be covered under RCRA if it contains nanowastes classified as hazardous waste
- Similar to sludge containing heavy metals
- Generator responsibility to determine if it is hazardous waste



# Recommendations to EPA: RCRA

- Determine whether specific nanowastes or categories of nanowastes should:
    - be listed as hazardous wastes
    - be classified as acute hazardous wastes
  - Review four hazardous waste characteristics
  - Review Toxicity Characteristic Leaching Procedure
  - Conduct research to determine if existing practices for bulk forms of solid wastes are appropriate for nanoscale wastes of the same chemicals.
- 



# Recommendations to Firms: RCRA



Photo courtesy of BBC news 2007

- Apply RCRA to nanowastes
- Promote and conduct research into appropriate methods of handling, treating, storing, and disposing of nanowastes

# Does CERCLA Cover Nanomaterials?

**Basic elements required for Superfund cleanup authorities to apply are broad enough to cover nanomaterials.**

Two principal ways by which  
a nanomaterial could become  
subject to CERCLA


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graph TD; A[Two principal ways by which a nanomaterial could become subject to CERCLA] --> B[If EPA decides that a substance currently subject to the statute includes the substance in its nano form]; A --> C[If EPA specifically designates a nanomaterial as a hazardous substance under CERCLA or under a statute referenced in CERCLA];
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If EPA decides that a substance  
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nanomaterial as a hazardous substance  
under CERCLA or under a statute  
referenced in CERCLA



# Does CERCLA Cover Nanomaterials?

- EPA authority to address releases of pollutants and contaminants that present an imminent and substantial danger could be used to address nanomaterials
    - **BUT** EPA would be limited to performing the cleanup itself and could not recover cleanup costs from responsible parties
  - Statutory liability exemptions
    - Quantity-based element
    - Toxicity component
  - Cleanup standards and processes are broad enough to apply to cleanups of nanomaterials
  - Statutory release reporting requirements could apply to releases of reportable quantities of nanomaterials
- 



# Recommendations to EPA: CERCLA

- Determine whether any current Superfund hazardous substances are produced in nanoform
  - If so, assess whether these substances also are hazardous in nanoform and, therefore, covered by the superfund program
- Assess whether to use authority under CERCLA to evaluate nanomaterials for purposes of determining whether they are hazardous substances
- Conduct outreach and education to small companies and start-ups





# Recommendations to Firms

***The private sector has responsibilities to assure that nanomaterials and nanowastes are managed safely and in accordance with law***

- Recognize that even if nanomaterials do not constitute hazardous wastes under RCRA, they could be determined by EPA to be hazardous substances under CERCLA
- Dispose of nanomaterials in a manner that accounts for the possibility that they could later be liable to the government or private parties
- Promote and conduct research into human health and eco-toxicity of nanomaterials and their fate and transport in the environment





# Questions?

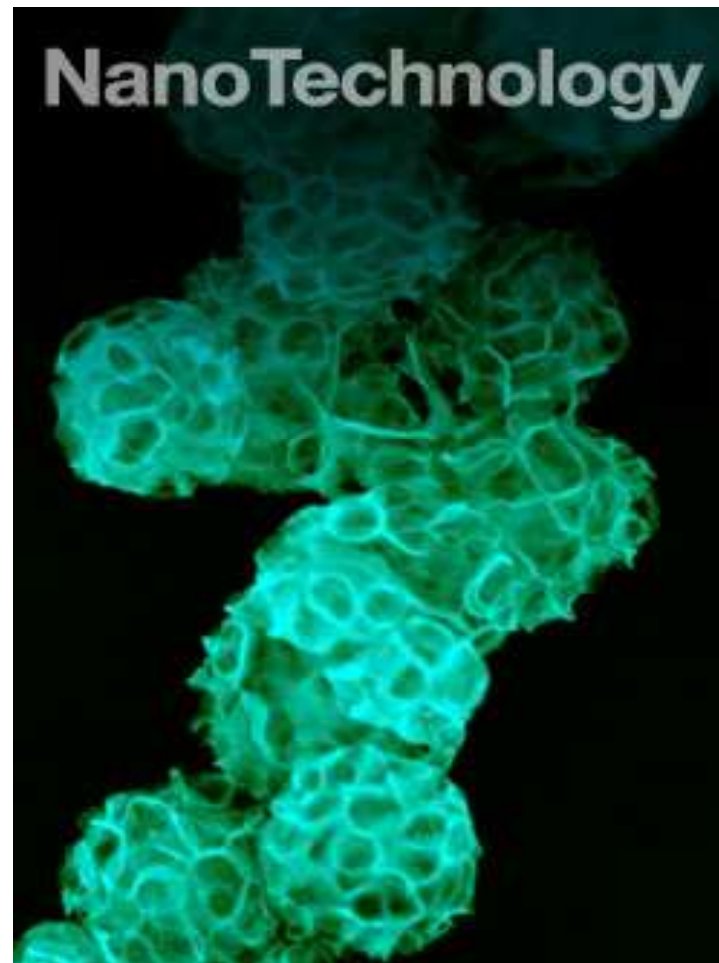


Photo courtesy of **Kanematsu USA Electronics** 2007



# Further Information

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