

Philosophical Issues in Future Applications

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“The Nanotechnology-Biology Interface: Exploring Models for Oversight”

Center for Science, Technology and Public Policy, Hubert Humphrey Institute of Public Affairs, University of Minnesota

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*nano*Science and Technology Studies at USC: *“On the Shoulders of Dwarfs”*



ⁿSTS: Mission

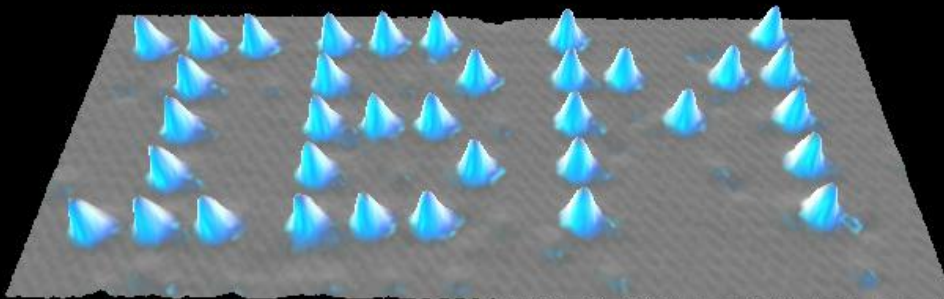
ⁿSTS is a group of researchers at USC trained in a variety of disciplines who pursue scholarly research and education about the societal, epistemological, and ethical dimensions of nanotechnologies. We recognize the value of multiple points of view and support contributions originating both from interdisciplinary perspectives and from the traditional disciplines. By design, our research bridges across the humanities, social sciences, sciences, engineering, medicine, and the professions. Work produced by ⁿSTS scholars may speak to a variety of audiences, including academics, students, those involved in government and policy, diverse professional fields, and lay publics.

<http://nsts.nano.sc.edu/mission.html>

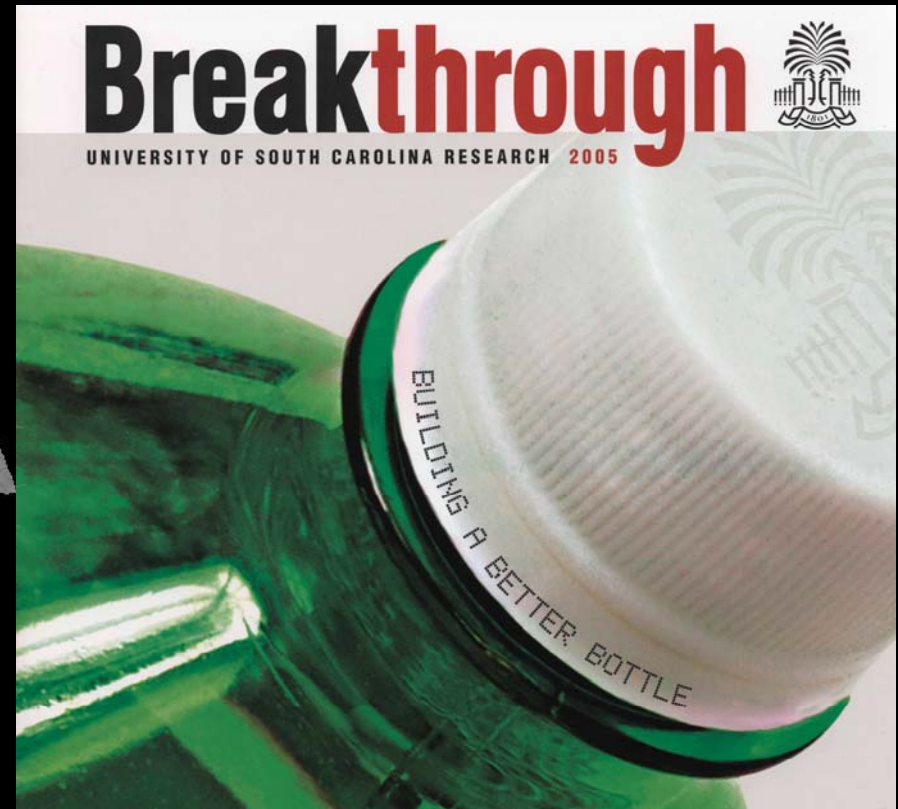
A word about a \$2 word: “epistemological”

- To productively and properly understand the “ethics” and “social policy” needed for nanotechnology we need to understand—*from the inside*—the practices that create our knowledge of the nanoscale and our ability to exploit the nanoscale for technological ends.
- Societal and Ethical *Interactions* of Nanotechnology
 - Not “impact”
 - Don’t “black-box” nano-techno-science and study its impact on society
 - Do open the black box and study the interactions between social and ethical practices and the practices creating knowledge at the nanoscale

Two Illustrations of USC's *n*STS analysis at work



Examining how images
of the nanoscale communicate

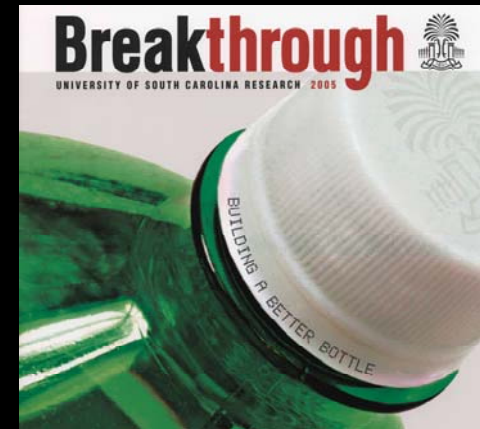


Examining how nano research
changes South Carolina and USC

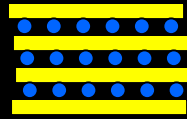


USC NanoCenter

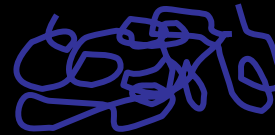
- Established in July 2001 with a special state appropriation of \$1M/year
- Five research thrusts
 - Nanopolymer composites
 - Catalysis
 - Nano-electronics
 - Nanobio
 - *n*STS
- Part of USC's "public/private" research campus, with a mission to grow SC's economy



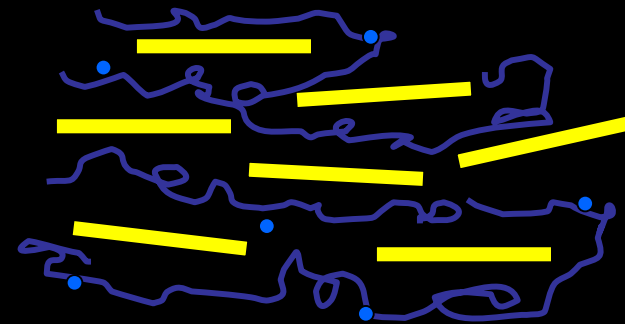
Thrust: Polymer Nano Composites



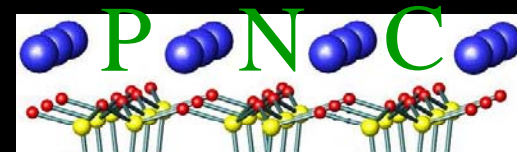
Layered Clay



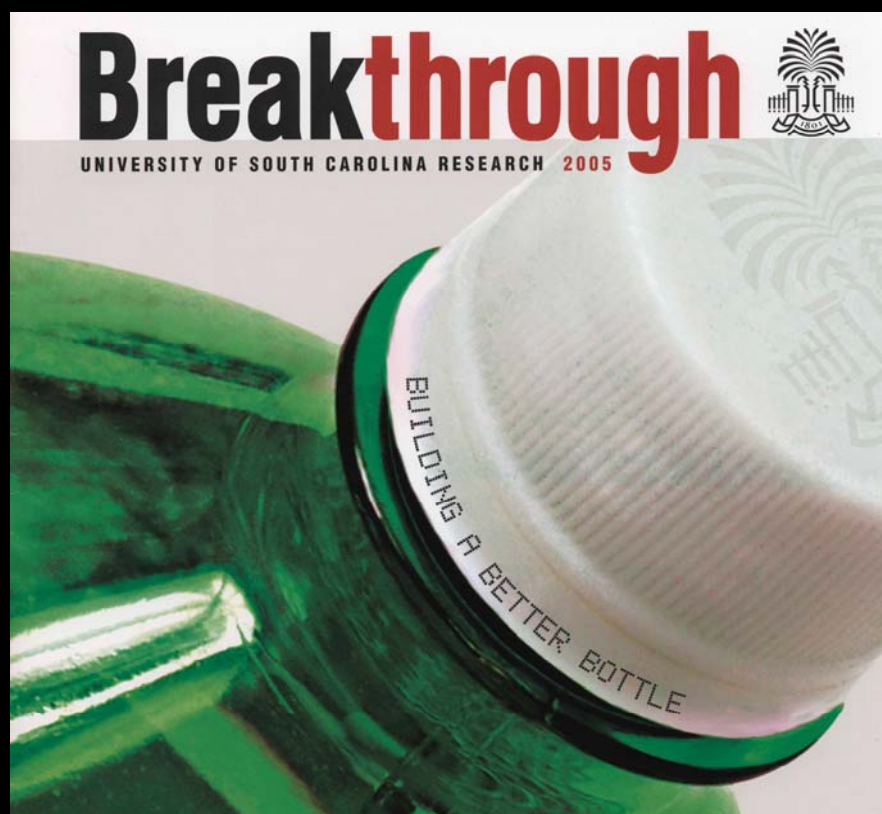
Polymer



Nanocomposite



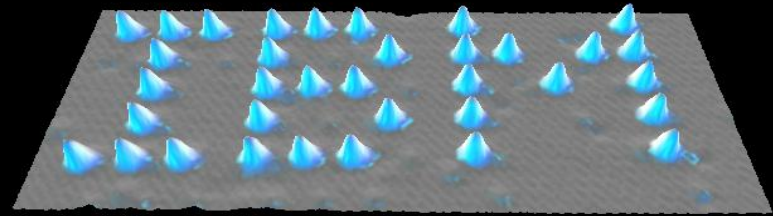
Reforming Institutions



- Growing Pains
 - Publishing
 - Graduating
- Tying Education to societal benefit —understood in the marketplace
- *n*STS helping self-awareness through this transition
 - of knowledge production
 - of intellectual property
 - of societal benefit and the marketplace
 - and distribution

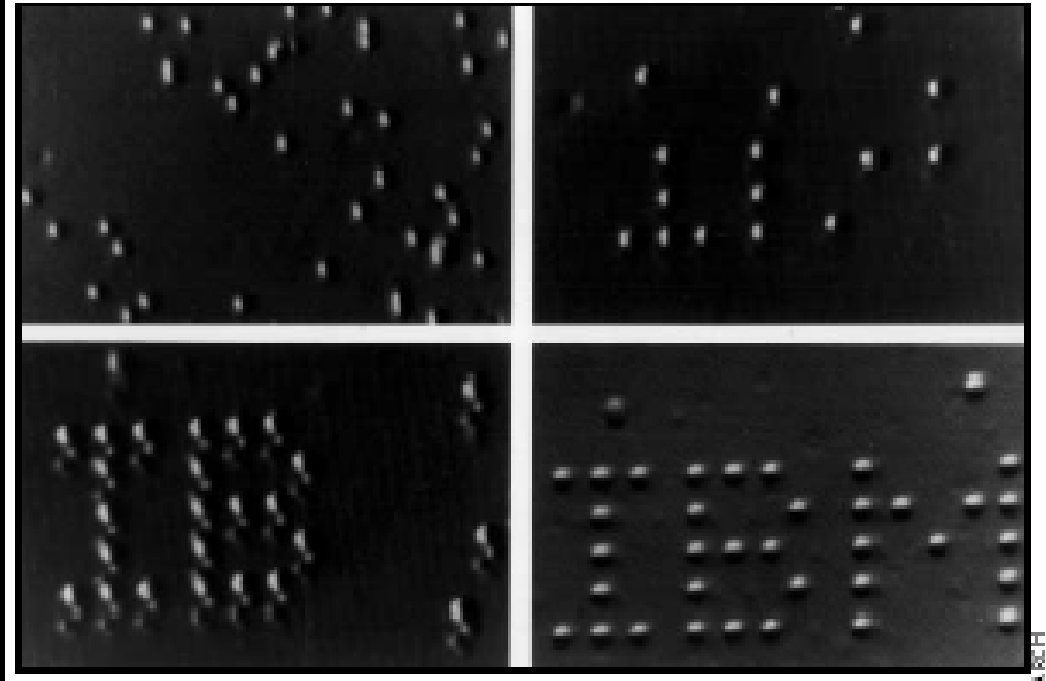
A familiar image

- Seeing is believing
- Touching—which had to be done to make this image—is proof
- The nanoscale is familiar
 - Just another place for logos and promotion



Don Eigler, 1989

But...



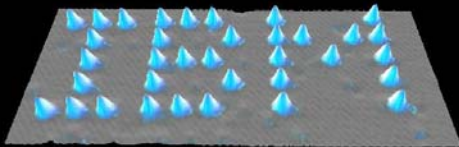
- Where did the color come from?
 - Is “true color” the antidote to Big Blue’s false blue?
- Where did the perspective come from?
- What context is lost?
 - Ultra-high vacuum
 - Near absolute zero
- And...

- Richard Jones: “The big difference between the macroworld and the nanoworld, if we are not at ultra-low temperature and in a vacuum, but in a water-filled beaker at room temperature, arises from the fact that water (and everything else) is made of molecules. These molecules are constantly flying around at high speed in random directions, hitting whatever happens to be in their way. ... Everything is continually being shaken up and jiggled around.”

What is the
nanoworld
like?

Images are “Intuition Pumps”

- What is the world of atoms like?
- Eigler’s familiar controlled world or...



- ... David Beveridge’s buzzing blooming confusion?

What will it take to better understand and use images of the nanoscale?

Nanotechnology images representational infrastructure

- Pictorial elements
 - Frame: size, ratio—length to height
 - Depiction of object boundaries,
 - Depiction of background elements
 - Depiction of depth
 - Depiction of scale: length and time
- Media elements
 - Tools for capturing or creating data
 - Tools for storing data
 - Tools for manipulating data
 - Tools for distributing data
 - Tools for representing data

Beveridge et al.,

T. Vicsek et al.

Take Home Messages

- 1. Nanotechnology's future applications will not impact society.
 - Researchers are developing polymer nano composites because they appear to have societal benefit.
- 2. Society will interact with the production and distribution of nanoscale knowledge and nanoscale products.
 - Images of the nanoscale will evolve as the understanding and use of them by multiple audiences evolves
- 3. Understanding and directing these interactions will require understanding the practices of knowledge production and dissemination
 - Creating a new “public/private” model of university research and commercial development will take understanding both partners
- 4. This understanding can only be achieved by bringing multiple different disciplines into fruitful exchange.
 - Gaining understanding and control over new media images calls on expertise ranging from microscopy, digital compression, to art and aesthetics

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