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Georgia Tech Institute of Paper Science and Technology

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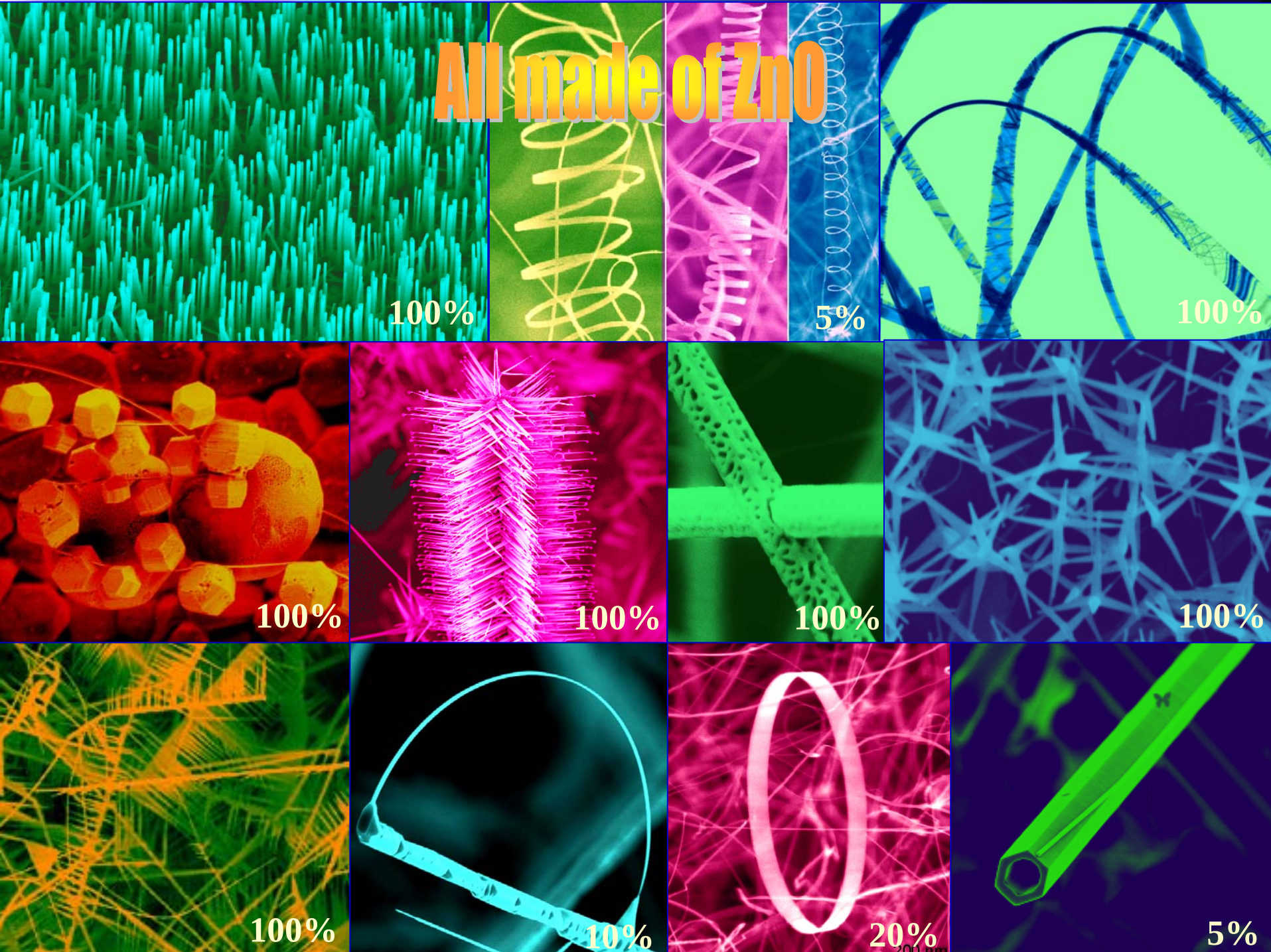
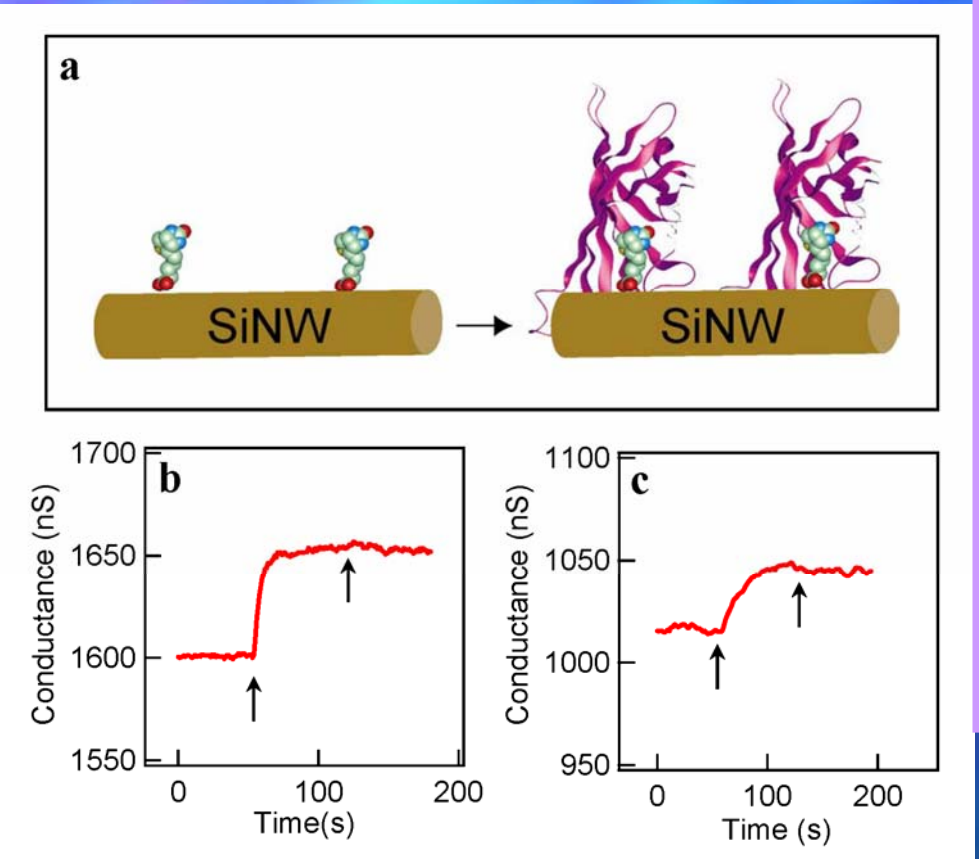
Panel

Evolving Industry Opportunuties

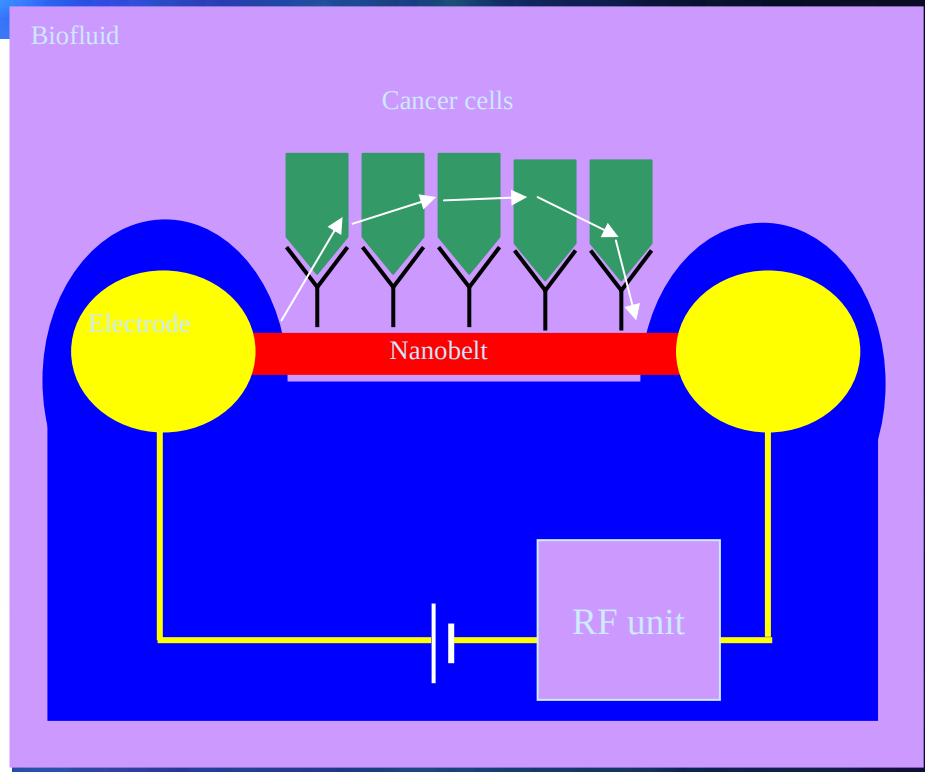
New Materials - Nanotechnology


All made of ZnO
100%
5%
100%
100%
100%
100%
100%
100%
10%
20%
5%

Detection of protein binding/cancer cells using a nanowire



(C.M. Lieber, Harvard)



In-situ, real-time, wireless detection of single cancer cells!

(Z.L. Wang, MSE, Georgia Tech)

SciTech Developments to Watch

EDITED BY OTIS PORT

INNOVATIONS

Electronic clothes and robot skin

>> At the Dec. 7-10 International Electron Devices meeting in Washington D.C., University of California at Berkeley researchers will reveal how they make electronic cloth by printing plastic transistors around textile fibers. And, since printing teensy transistors on the curved surface of cloth fibers isn't

SMART SWATCH Could this Intel Celeron chip get competition from cloth?

AVIATION

A WISP OF A JET TO CIRCLE THE GLOBE

WITH THE CENTENNIAL of the Wright Brothers' first flight coming up on Dec. 17, aviation buffs will be watching to see if a modern replica of the Wrights' plane can duplicate their feat at Kitty Hawk, N.C. That same

composites airframe with a wingspan of 114 feet—roughly the same as a Boeing 737—but weighs just 3,577 pounds, until loaded with 18,000 lbs. of fuel. It could set new standards in flight efficiency and buff Rutan's

built for one of aviation's last grand challenges: a nonstop solo flight around the world.

May. At the controls will be Steve Fossett—famous for circling the globe solo in a hot-air balloon last year. Virgin Atlantic Airways is backing the venture.

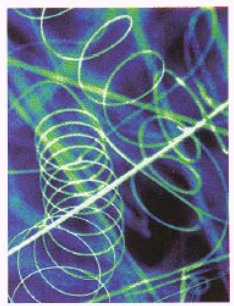
the American Medical Assn. presents tantalizing evidence that this works. Doctors at Cleveland Clinic and other centers gave synthetic HDL to 36 atherosclerosis patients. In just six weeks, plaque decreased by more than 1%, on average. "For the first time, we've shown we can rapidly regress plaques in a high-risk population," says Roger Newton, CEO of Ann Arbor (Mich.) startup **Esperion Therapeutics,** which created the biotech HDL. The test will be whether this treatment actually prevents heart attacks. Researchers predict that HDL boosters could be at least as beneficial as the current LDL-lowering drugs. *–John Carey*

NANOTECH

THE NEXT FRONTIER: NANO-SLINKIES

NO, THE HELICAL shapes shown below aren't DNA, although they're almost as tiny. A DNA helix is about 2 nanometers across; these metal strands are at least 10-nm wide—still a smidgen next to a human hair's 100,000-nm diameter. Despite their size, these "nanosprings" could do some heavy lifting in future devices, says Zhong Wang, director of **Georgia Institute of Technology**'s Center for Nanoscience & Nanotechnology.

Made from zinc oxide, the springs are piezoelectric—meaning they can transform mechanical motion into electricity or vice-versa. Ultrasensitive nanospring detectors could flash a signal when perturbed by minute forces such as otherwise imperceptible flows of a liquid or gas. Conversely, a nanospring could expand in response to an electrical signal and push a microdrop of insulin from a capsule implanted in a diabetic patient. First, though, Wang's team has to devise ways of calibrating the springs' properties.

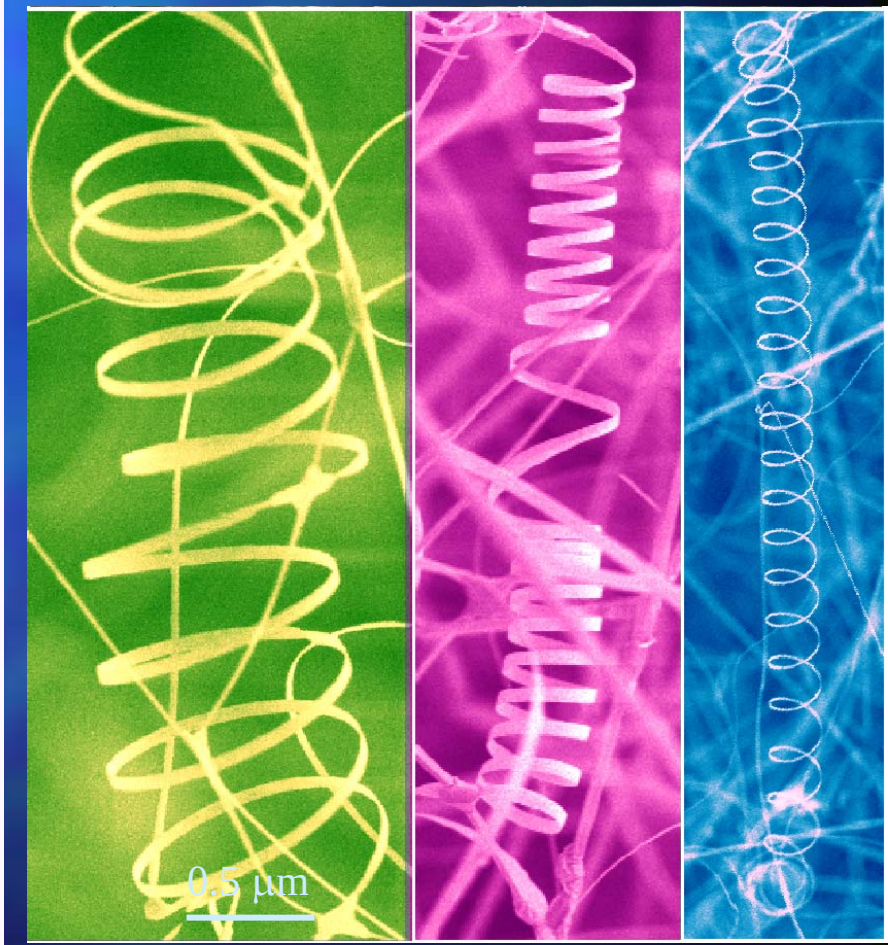


Piezoelectric ZnO Nanostructures

***Business week*, Nov. 17, 2003**

Georgia Tech Institute of Paper Science and Technology

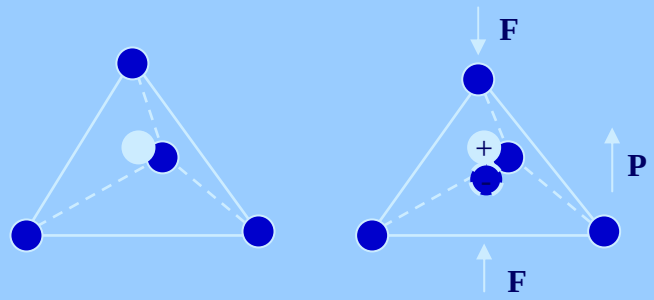
Piezoelectric nanosprings for ultrasensitive measurements of pressure and flow rate in blood vessels and in brain (Z.L. Wang, MSE, Georgia Tech)

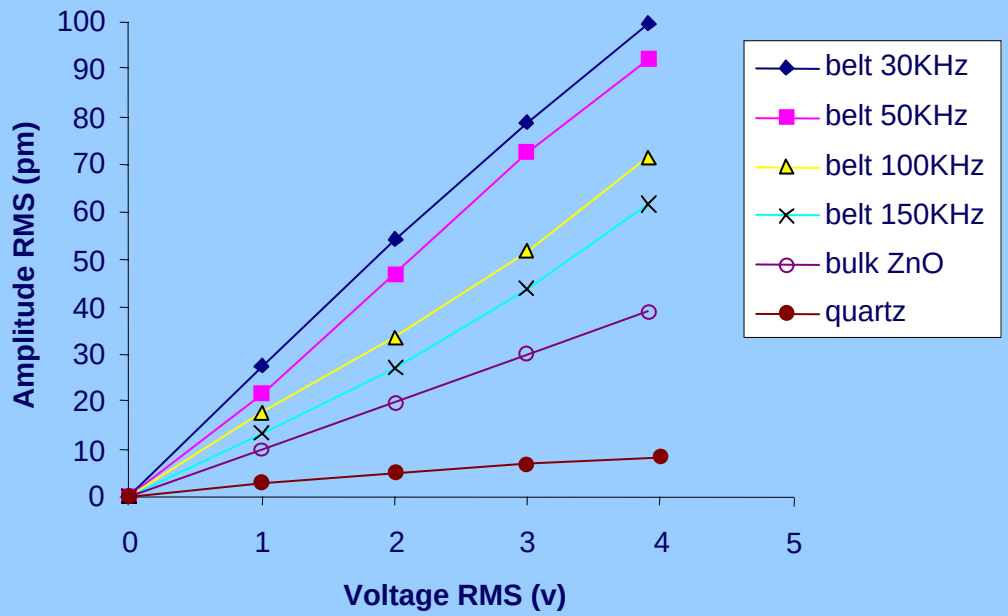


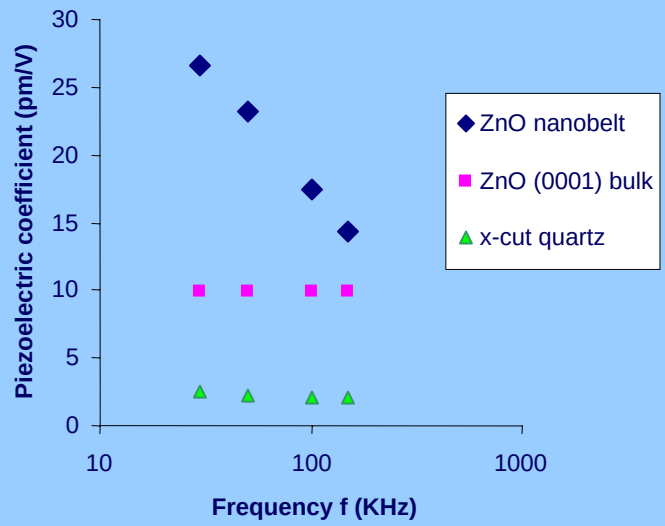
Kong & Wang, Nano Letters, 3 (2003) 1625 + Cover

Enhanced piezoelectric properties at nano-scale

Piezoelectric effect:







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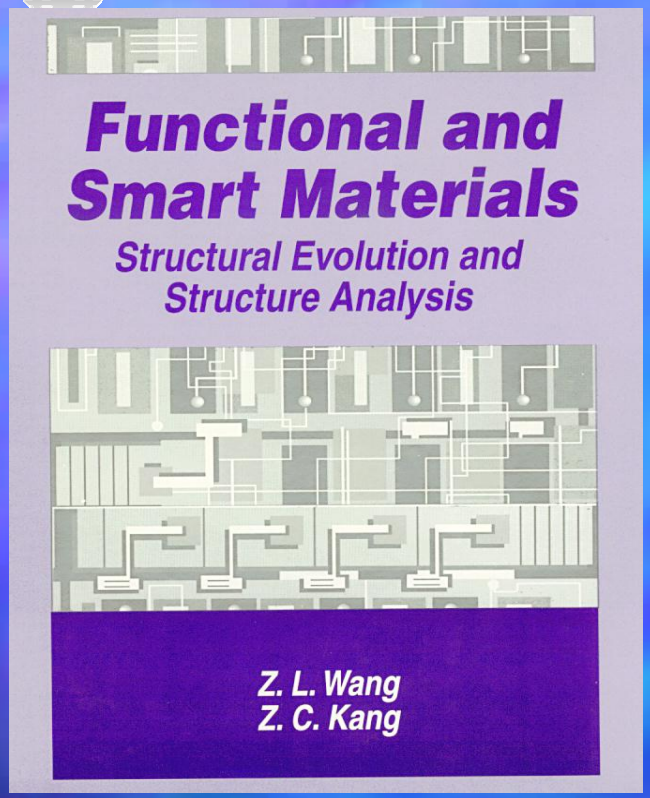
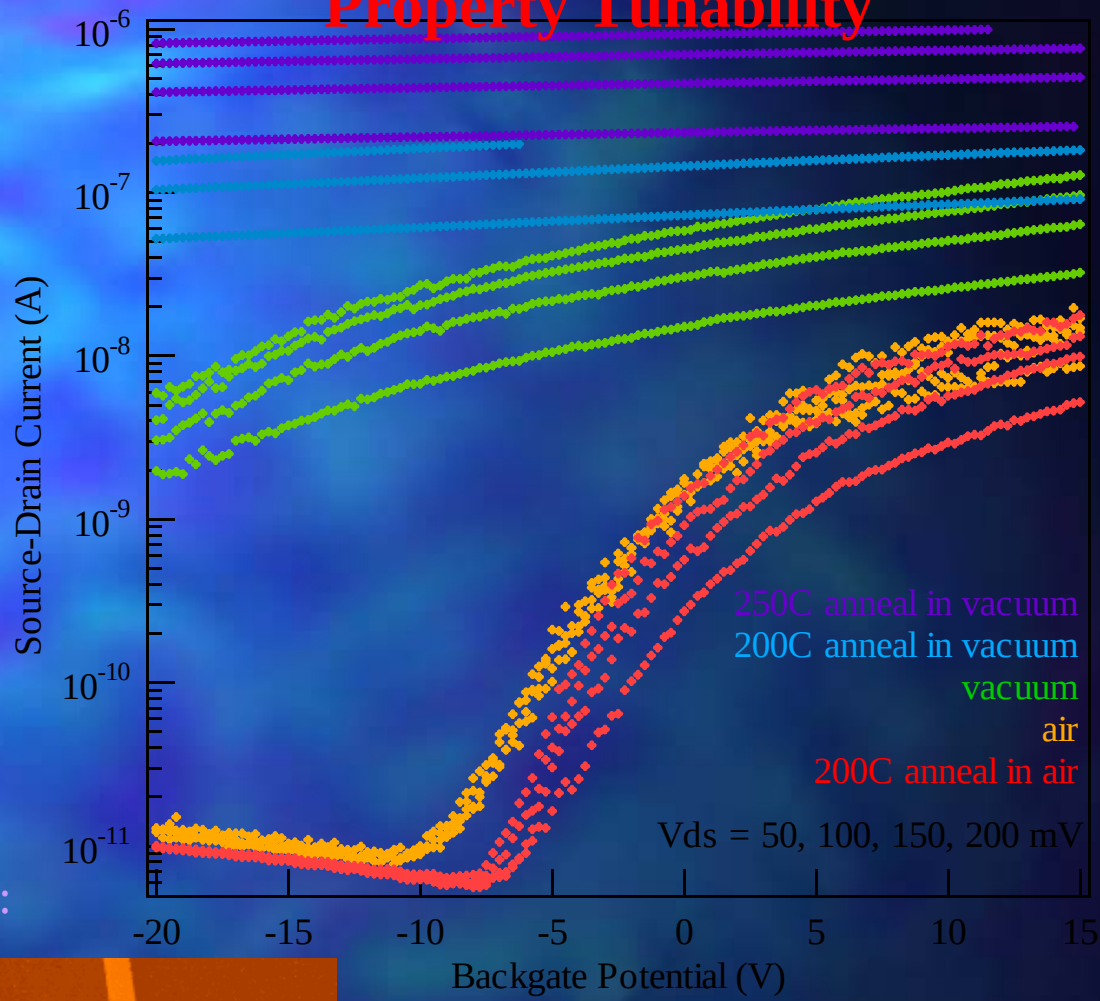


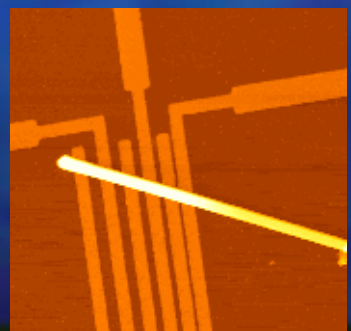
Plenum, 1998

Property Tunability



Unique advantages of functional oxides:

- Cations with mixed valences
- Anions with deficiency



J. Phys. Chem. B, 107 (2003) 659-663

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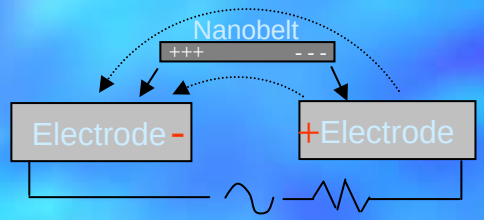
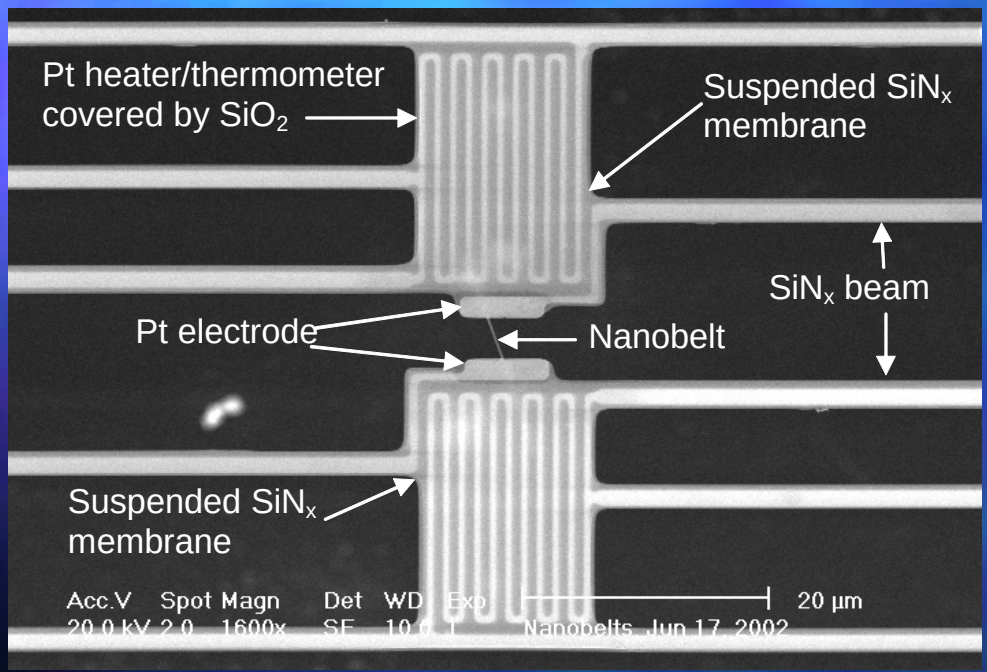
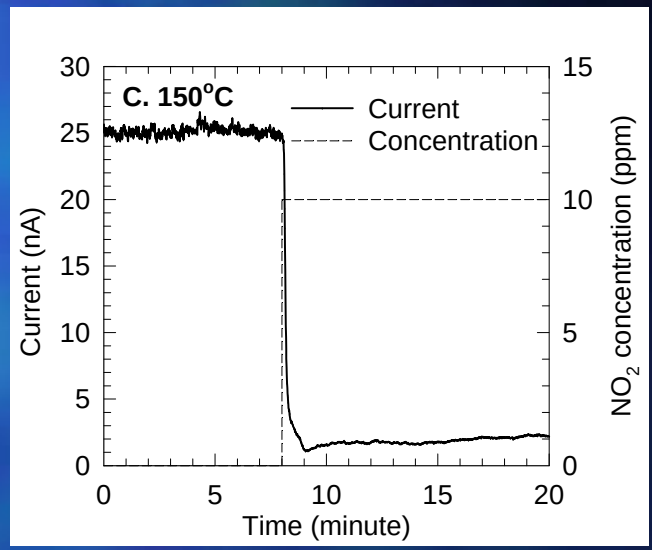
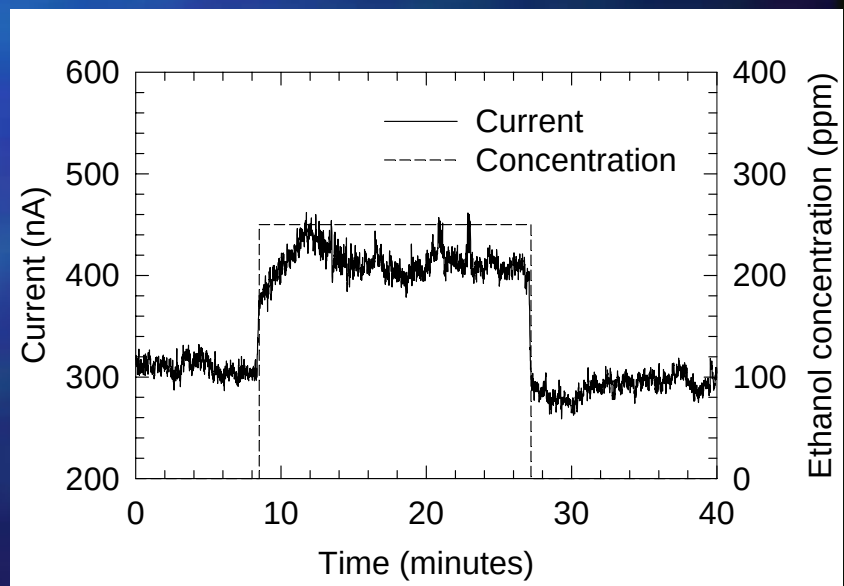
Integration of nanobelts with MEMS for gas sensing



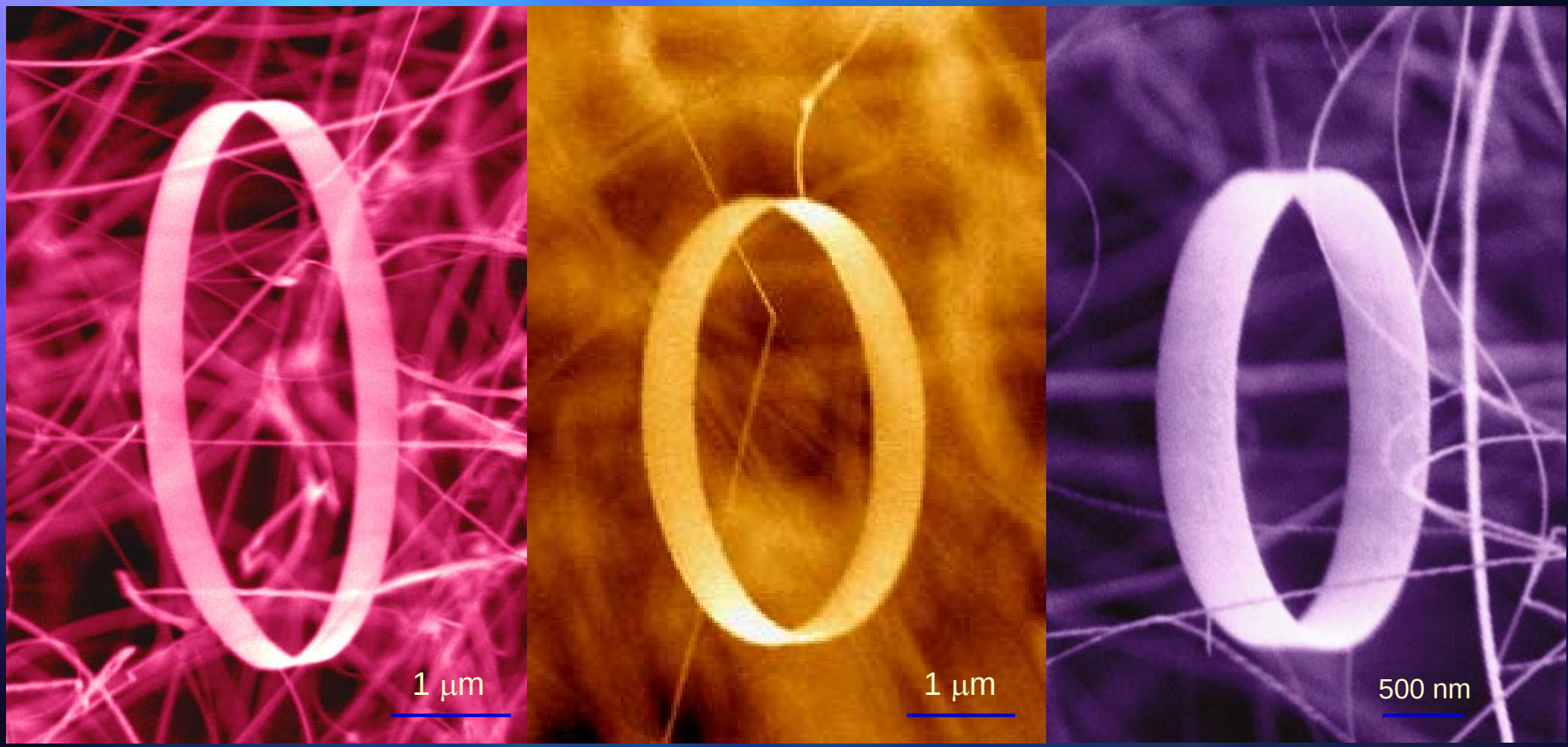






(Li Shi, UT Austin)

Single-crystal, complete-rings of piezoelectric and semiconductor ZnO



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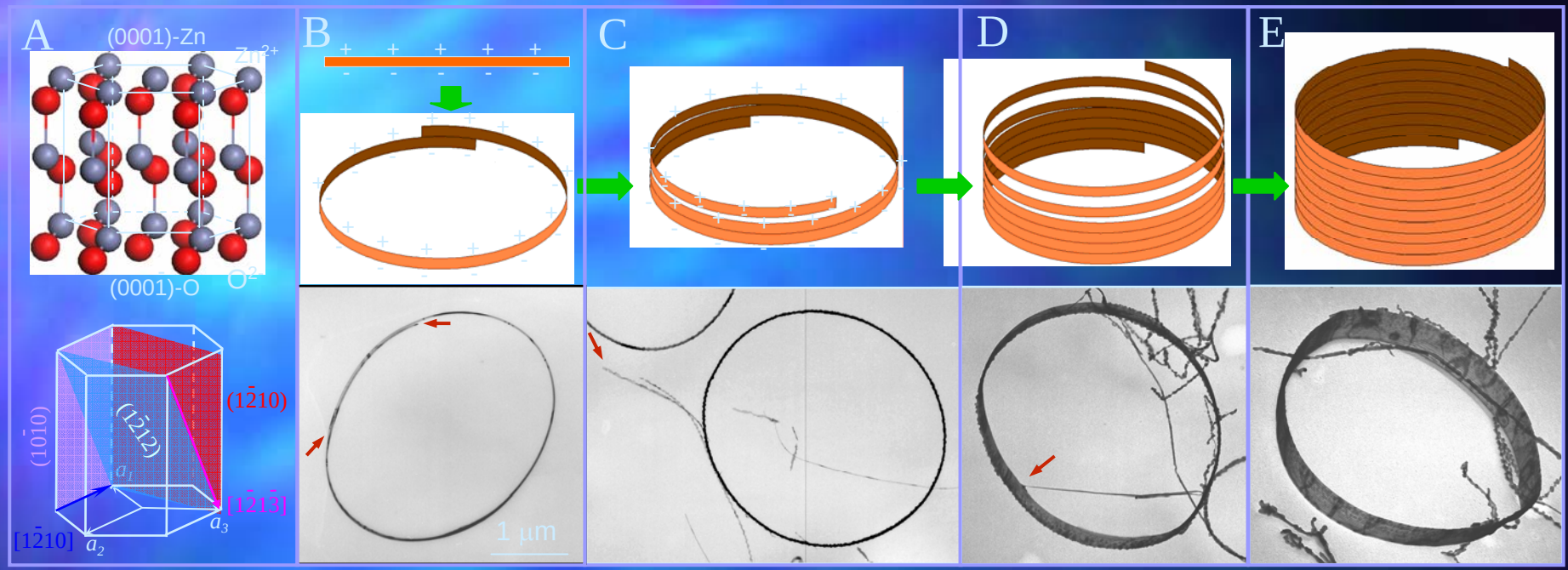
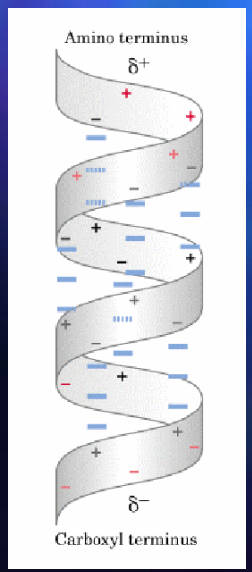
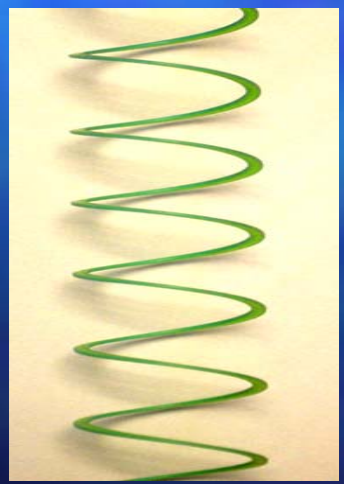
Polar surface induced structural configurations







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SCIENCEWATCH®

TRACKING TRENDS AND PERFORMANCE IN BASIC RESEARCH

Sweating the Small Stuff, 1992–2002

Nanotechnology Research

Institutions Ranked by Citations and Citation Impact

(among those that published ≥100 nanotechnology papers, 1992-2002)

Rank	Institution	Citations 1992-2002	Rank	Institution	Impact 1992-2002
1	Univ. Calif., Berkeley	15,507	1	Rice University	37.64
2	IBM	11,587	2	NEC Corporation	28.64
3	MIT	10,830	3	Colorado State University	25.32
4	Chinese Academy of Sciences (PRC)	9,814	4	Michigan State University	24.96
5	Ecole Polytech. Fed. Lausanne	9,758	5	Lucent Technologies	24.48
6	Rice University	9,750	6	Harvard University	23.68
7	NEC Corporation	7,963	7	Lawrence Berkeley Natl. Lab	23.30
8	Univ. Calif., Santa Barbara	7,599	8	University of Pennsylvania	23.02
9	Harvard University	7,578	9	IBM	21.34
10	Northwestern University	6,821	10	Univ. Calif., Berkeley	21.24
11	Tohoku University	6,296	11	Univ. Calif., Santa Barbara	20.93
12	Georgia Tech	6,150	12	University of Utah	20.25
13	U.S. Navy	5,952	13	Ecole Polytech. Fed. Lausanne	19.17
14	Russian Academy of Sciences	5,849	14	Delft University of Technology	18.83
15	University of Tokyo	5,717	15	MIT	17.73
16	CNRS (France)	5,680	16	Hahn-Meitner Institute, Berlin	17.30
17	Pennsylvania State University	5,588	17	Caltech	17.02
18	University of Illinois	5,579	18	Natl. Renewable Energy Lab	16.69
19	Lucent Technologies	5,166	19	Princeton University	16.42
20	Cornell University	4,922	20	University of Liverpool	16.30
21	University of Paris 6	4,750	21	University of North Carolina	16.27
22	Osaka University	4,595	22	Northwestern University	15.90
23	Caltech	4,527	23	University of Toronto	15.85
24	Delft University of Technology	4,518	24	Stanford University	15.84
25	University of Minnesota	4,249	25	University of Kentucky	15.69

SOURCE: Topical Citation Report: Nanotechnology, 1992-2002

US
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Thomson ISI-indexed journals. Pertinent variations on "nano-" included "nanocrystal," "nanotube," "nanocomposite," "nanofabrication," and impact lists, an achievement also shared by IBM, NEC Corporation, and Harvard.

Continued on page 2