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# Materials Science and Engineering at UC Berkeley

Robert O. Ritchie  
Chair

Department of Materials Science  
and Engineering

Community College Day  
Friday, November 2, 2007



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University of California at Berkeley



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What is

**MISER**

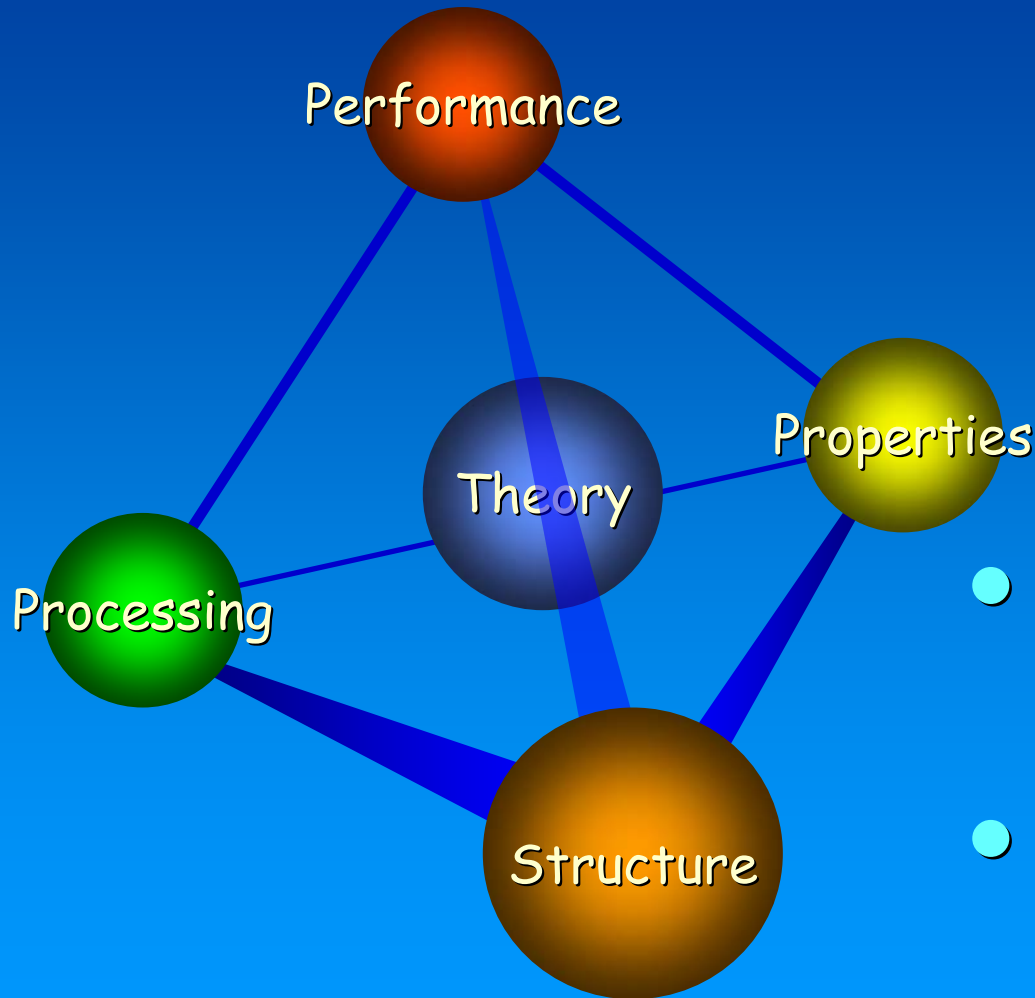
...is this the right choice?



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# Materials Science & Engineering!



- the major link between science and engineering
- and vital to so many disciplines in between!



# Materials for Engineering

## ● Petronas Towers

- ◆ Kuala Lumpur
- ◆ Taller
- ◆ Faster
- ◆ Lighter
- ◆ Concrete
- ◆ Fenestration

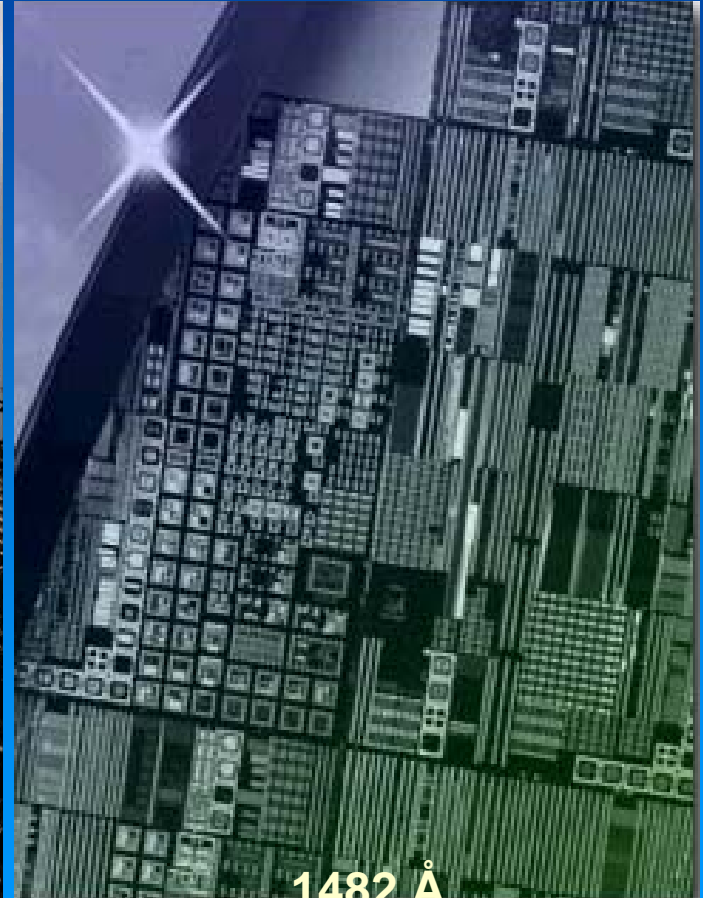
## ● IC Wafer

- ◆ Santa Clara
- ◆ Smaller
- ◆ Faster
- ◆ Lighter
- ◆ Silicon
- ◆ Integration



1482 ft

32,000 windows



1482 Å

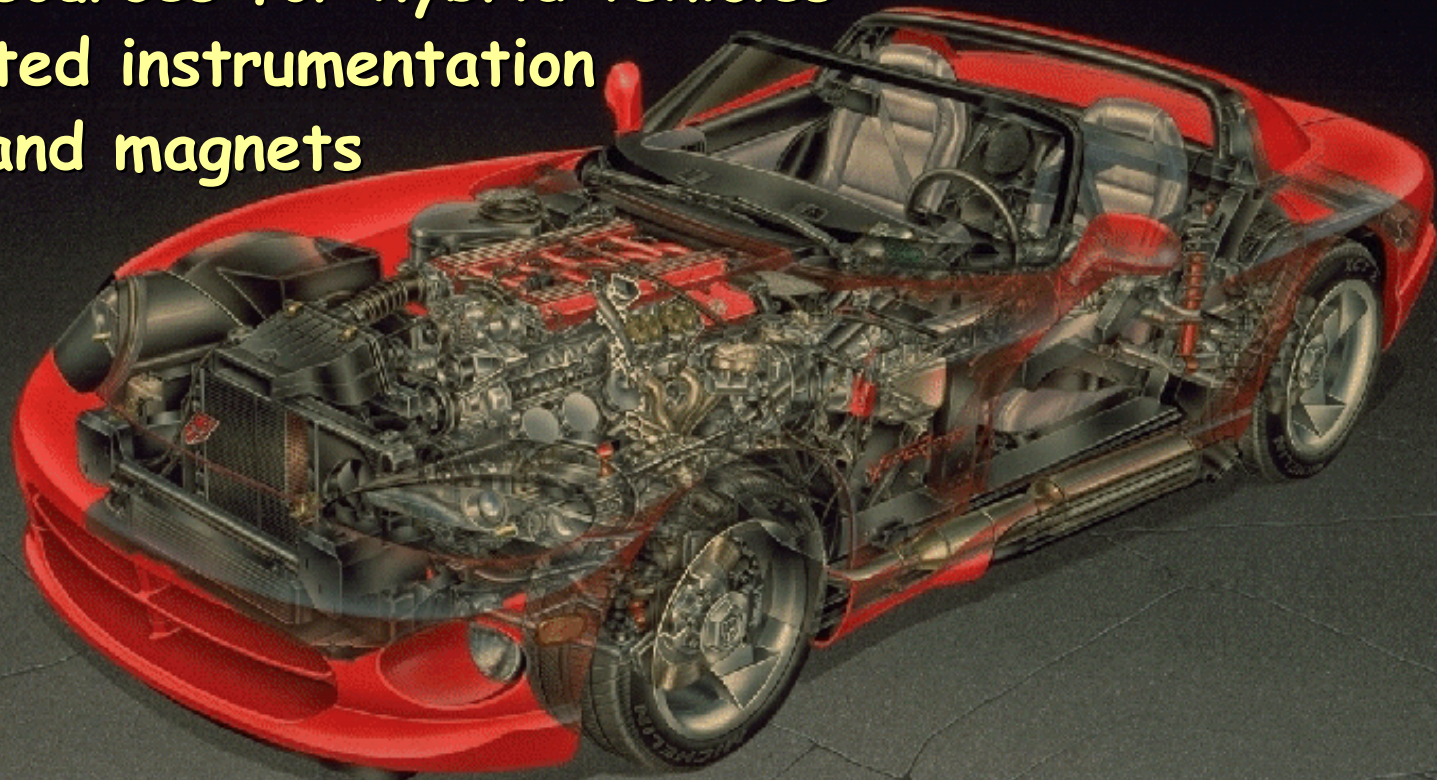
32,000,000 transistors



# "Transportation Materials"

- *Transportation*

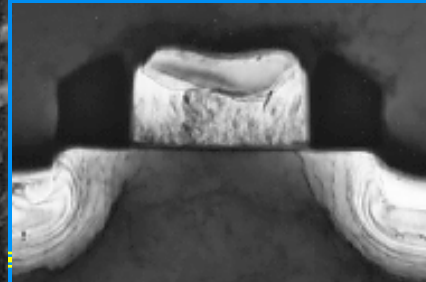
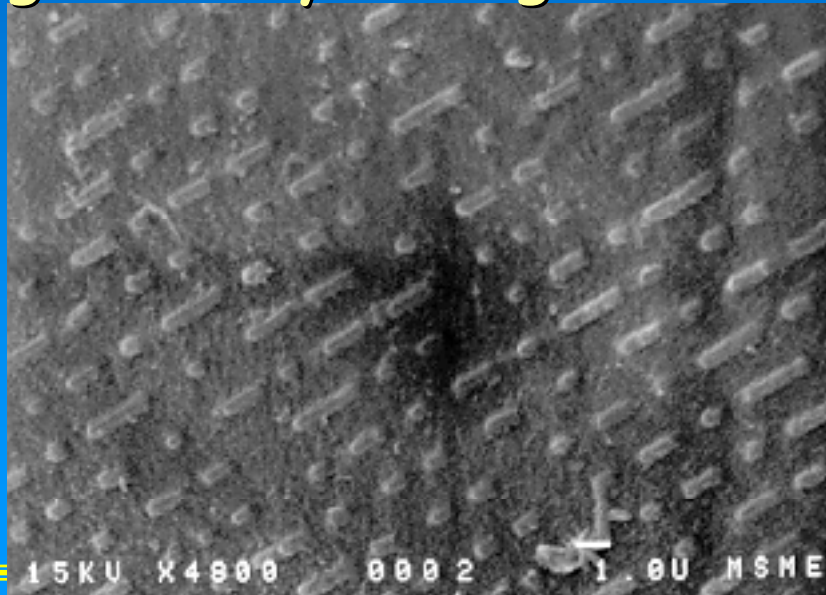
- ◆ Safe, crashworthy
- ◆ Responsive, "smart"
- ◆ Energy sources for hybrid vehicles
- ◆ Integrated instrumentation
- ◆ MEMS and magnets



# Optoelectronic Materials

## ● Information

- ◆ Electronics, photonics
- ◆ Lasers, diodes, flat-panel displays
- ◆ Quantum confined structures
- ◆ Ultra-high density storage media

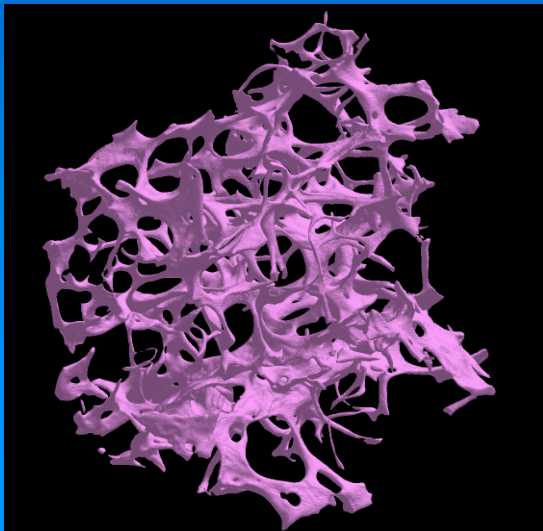


# Biomaterials

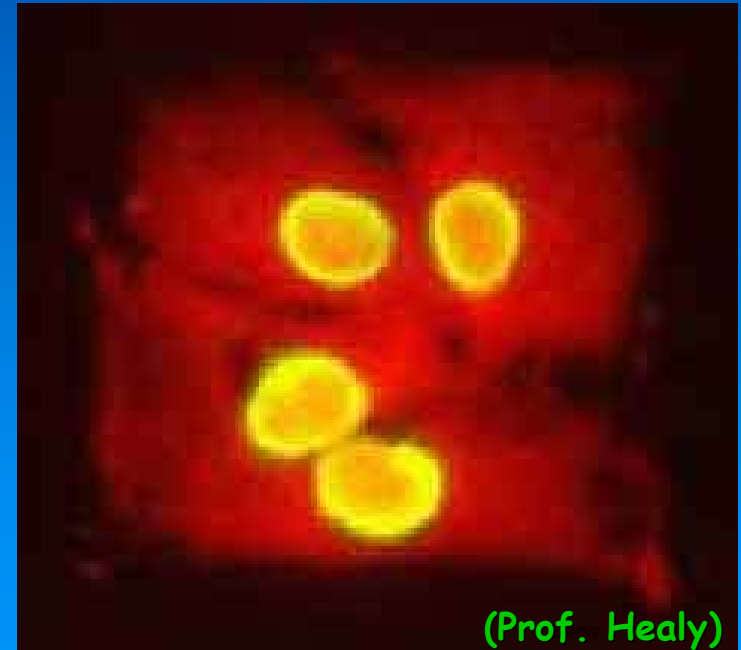
- Biomimetic materials and tissue engineering
- Biologically defined microdevices
- Aging and disease of biological materials



metallic implant in bone



X-ray computed tomography of trabecular bone  
(Prof. Ritchie)



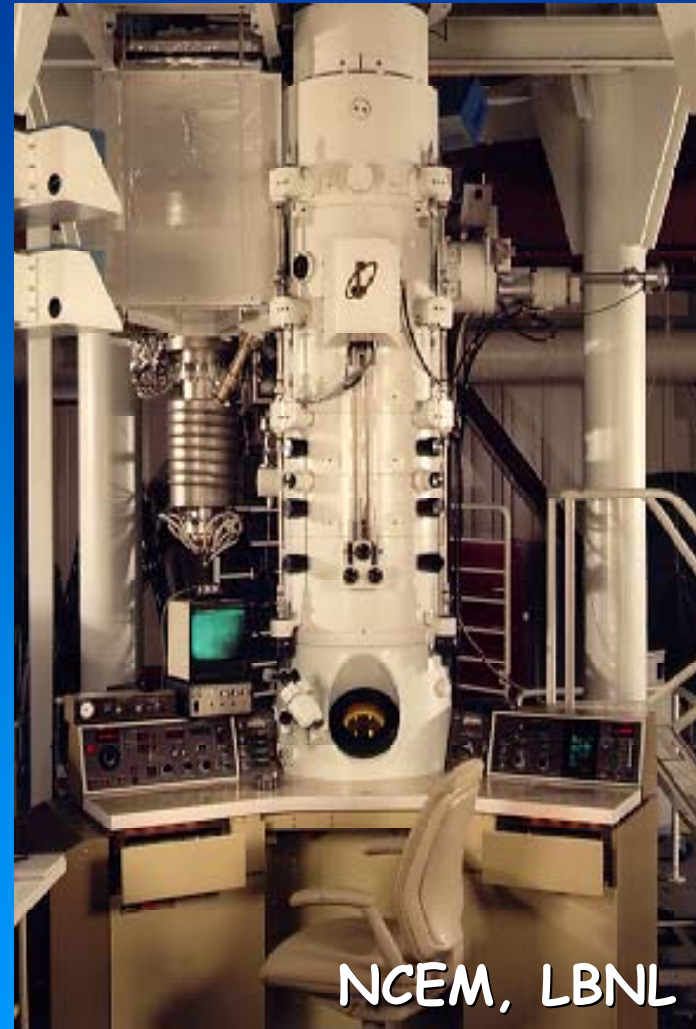
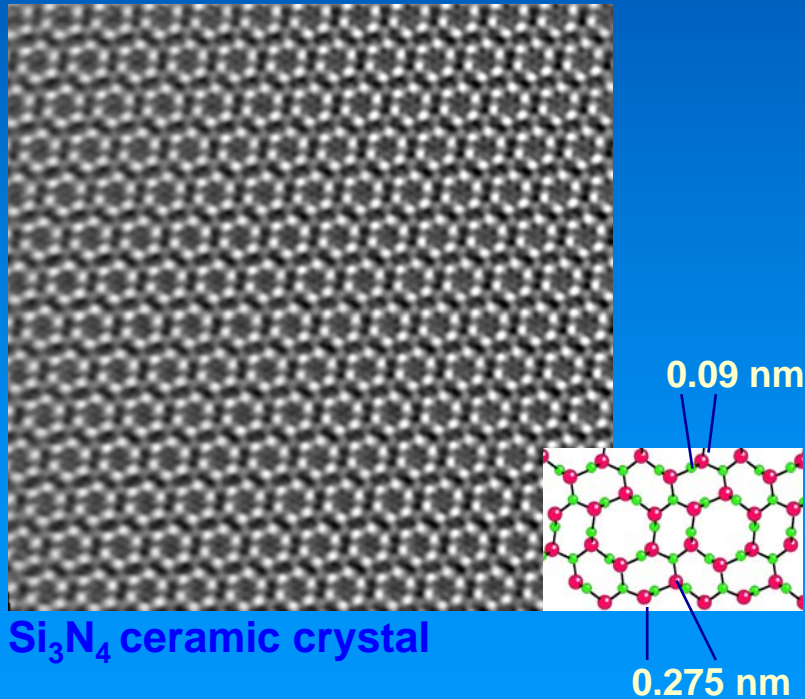
(Prof. Healy)

biomimetic materials regulate bone cell function



# Structural Characterization

- Imaging atoms, etc.
- Resolution =  $< 0.1$  nm



# Nanostructured Materials

## ● Carbon-60

- ◆ 60 C atoms at corners of a 20-sided icosahedron
- ◆ “BuckyBalls”
- ◆ “BuckyOnion”
- ◆ “NanoTubes”
- ◆ Nanoscale machines

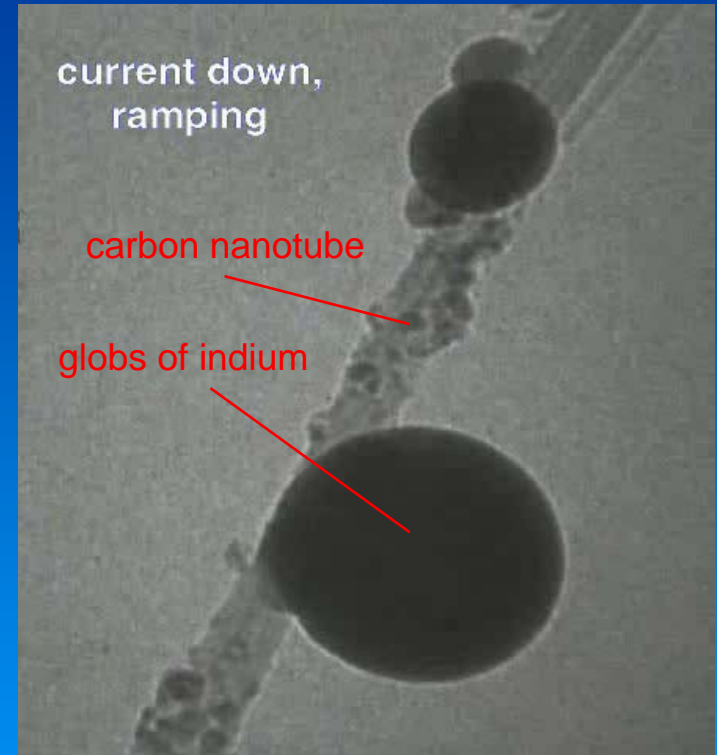
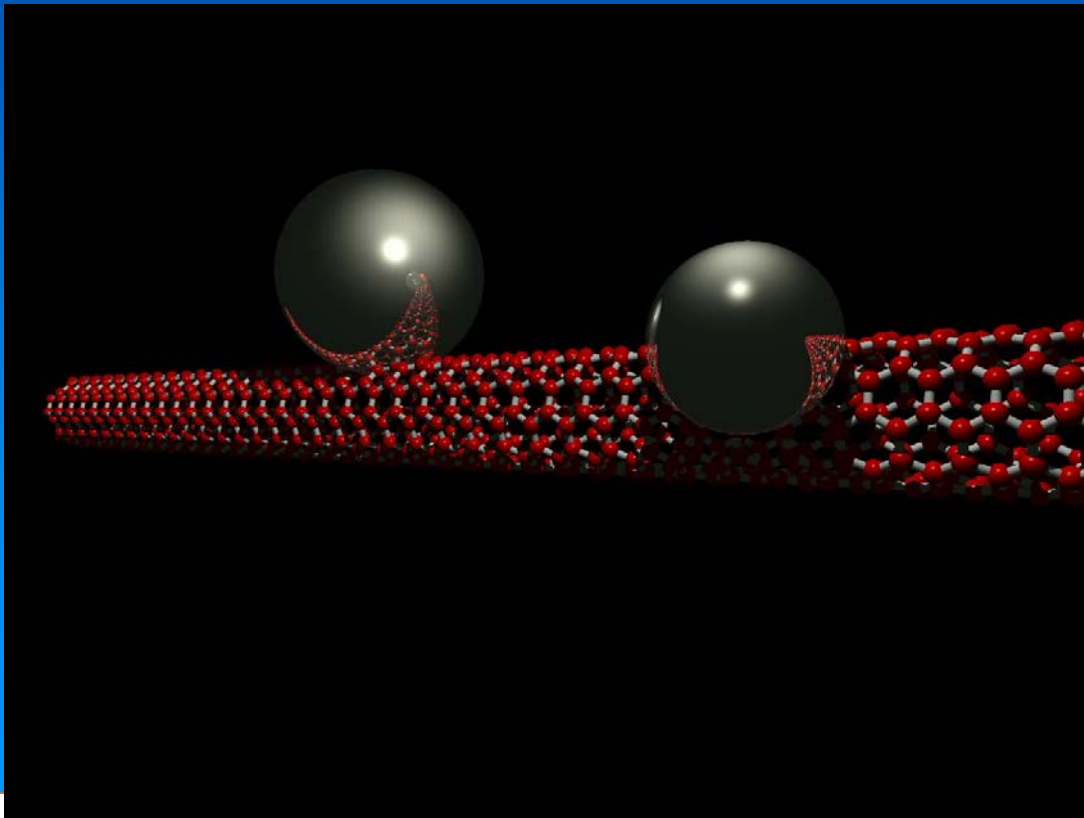


Nanotube Bearing  
Alex Zettl



# New Ideas for Nanomotors

- by reversing the electrical current along a carbon nanotube, we can move metal globs
- by putting the metal globs between two nanotubes, we can move them apart and do work



5 nm

TEM image

animation



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