Welcome

to the

Metallurgy Division

and the

10th NIST Diffusion Workshop

Multicomponent Diffusion Data and Its Impact on the Materials Design Process

May 3-4, 2012

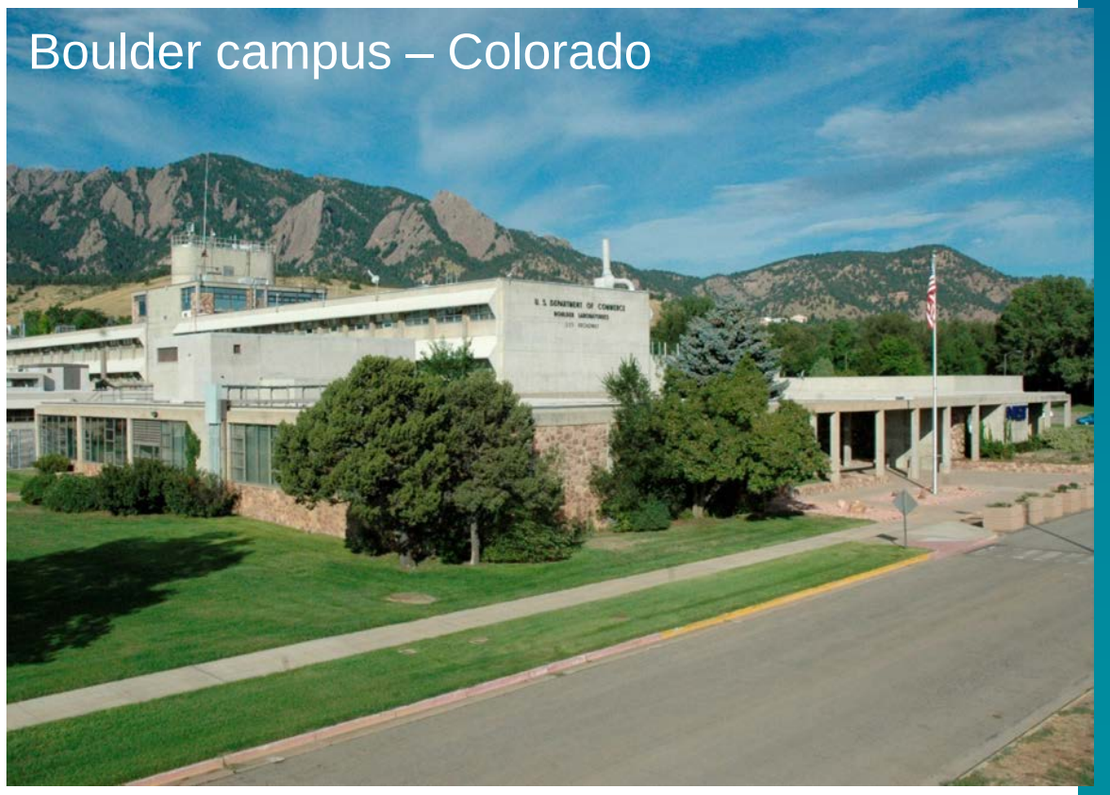
Frank W. Gayle
Chief, Metallurgy Division

NIST

NIST is part of the Department of COMMERCE

NIST Laboratories – DoC ☐ The View from 10,000 ft.

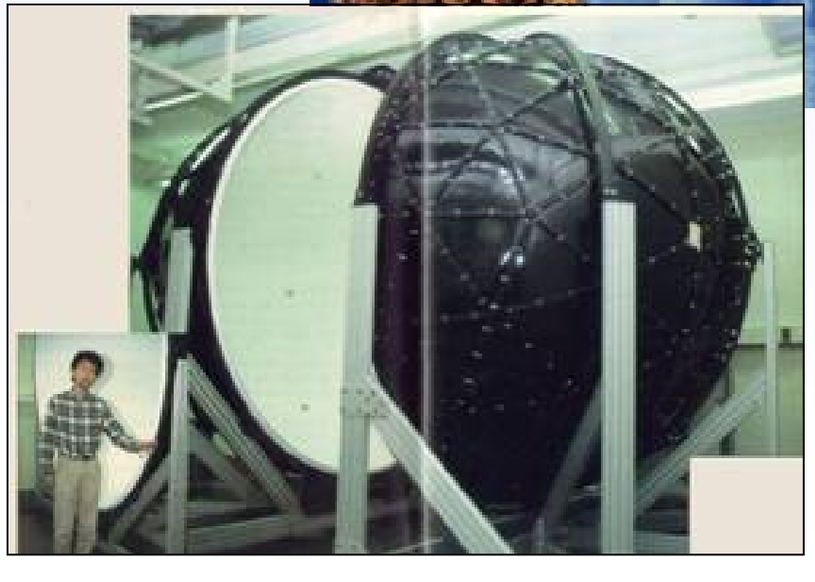
- The Nation's National Measurement Laboratory
- **Central Mission**: Support industrial innovation with Measurements, Standards, and Data
- Extremely broad research portfolio
- Established in 1901 – Nation's oldest physical science laboratory
- "Where Nobel Prize science meets real world engineering"
- World class facilities, national networks, international reach



NIST Products and Services Include

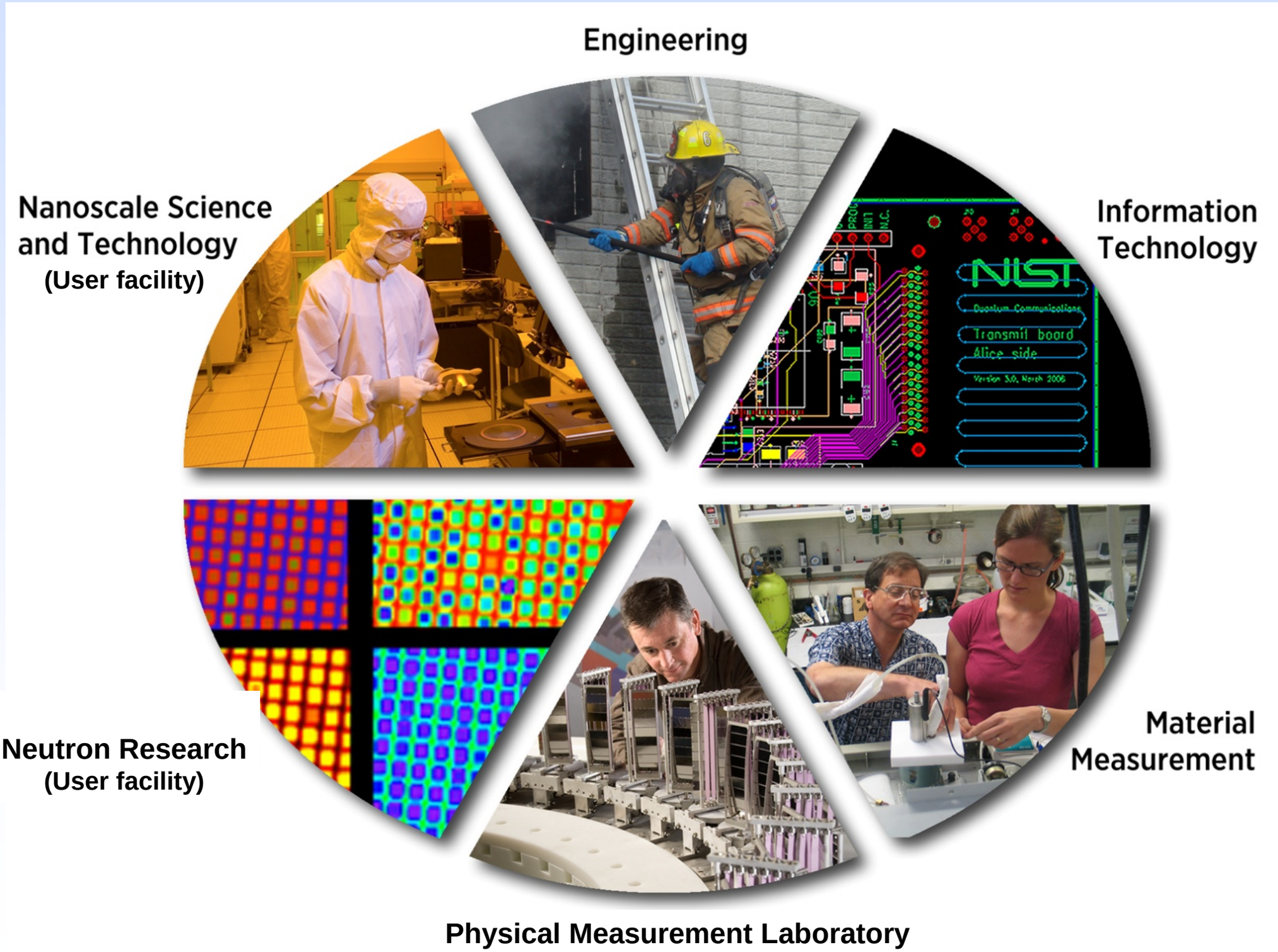
- **Measurement Research**
  2,200 publications/year
- **Standard Reference Data**
  100 types available
  130 million datasets downloaded/year
- **Standard Reference Materials**
  1,300 products available
  33,000 units sold/year

- **Technical Workshops -** *8,000 participants/year*
- **Standards Committees**
  400 members, 1000 committees,
  150 (co)chairs, 100 SDOs



- **Calibrations and Tests**
  16,000 calibrations/year
- **Laboratory Accreditation**
  800 accreditations

NIST Laboratories and User Facilities



Material Measurement Laboratory

$100 M Congressional Appropriations
$ 40 M Other funds

Director
Willie E. May

Deputy Director
Richard R. Cavanagh

Measurement Services
Standard Reference Materials
Standard Reference Data

Ceramics

Materials Reliability

Polymers

Metallurgy

Biochemical Science

Chemical and Biochemical Reference Data

Surface and Micro-analysis Science

Thermo-physical Properties

Analytical Chemistry

Material Measurement Laboratory

$100 M Congressional Appropriations
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Laurie Locasio

Director

Measurement Services

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Surface and Micro-analysis Science

Thermo-physical Properties

Analytical Chemistry

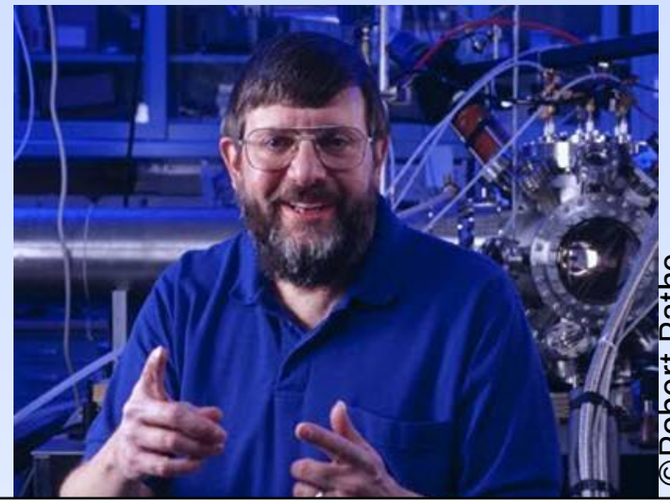
NIST has ... ... world-class staff

© Geoffrey Wheeler

Jan Hall
2005 Nobel Prize
in Physics

© Geoffrey Wheeler

Eric Cornell
2001 Nobel Prize
in Physics



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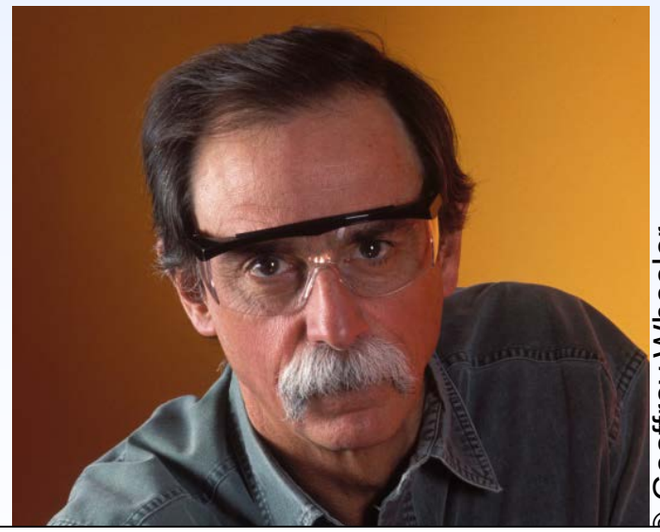
Bill Phillips
1997 Nobel Prize
in Physics



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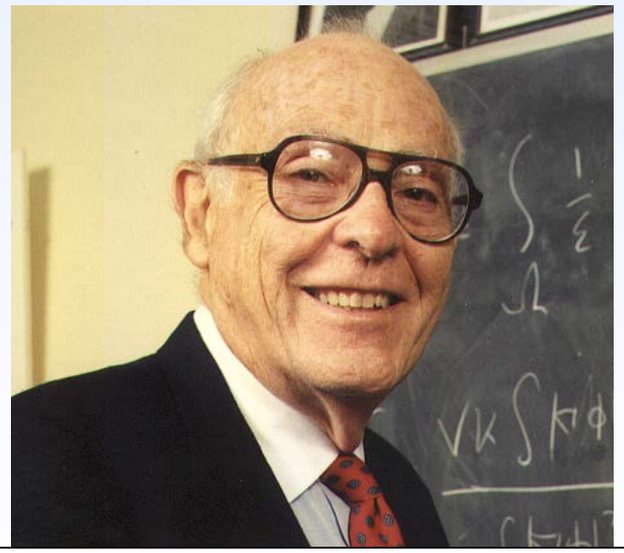
David Wineland
2007 National Medal
of Science



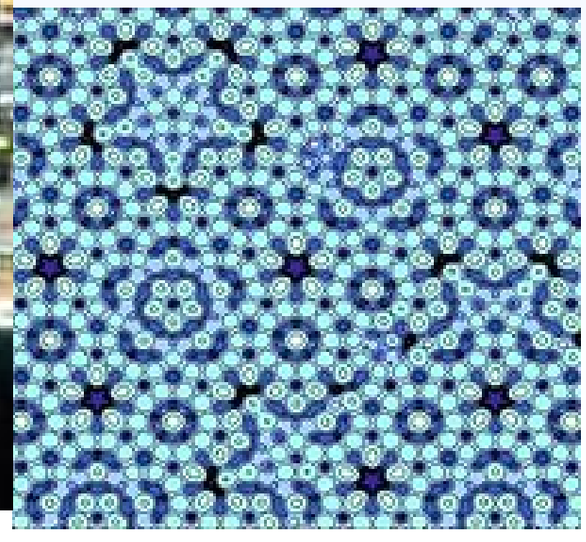
John Cahn
1998 National Medal
of Science

Recognition of Metallurgy Division Staff

Dr. John W. Cahn

2011 Kyoto Prize

for Fundamental Contributions to Materials Science



Dr. Dan Schectman

2011 Nobel Prize in Chemistry

For the discovery of Quasicrystals

Discovery in 1982, Metallurgy Division, NIST

Metallurgy Division

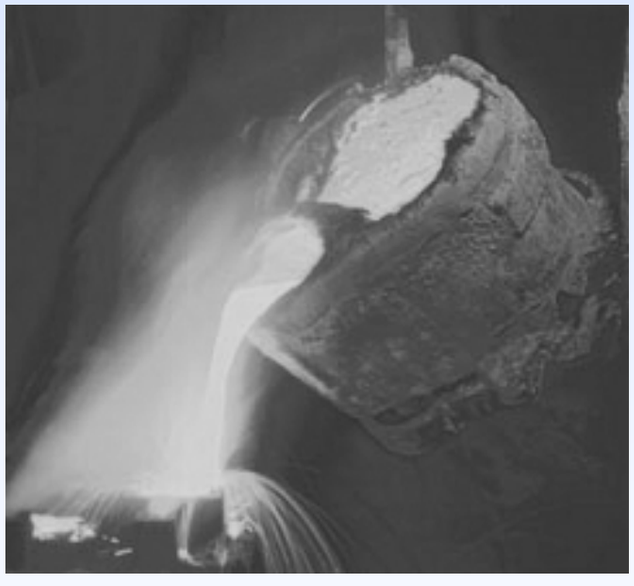
Early drivers for standards and measurements

1904

Out-of-town fire companies arriving at a Baltimore fire cannot couple their hoses to the hydrants. 1526 buildings razed.

1905

Standard samples program begins with standardized irons.



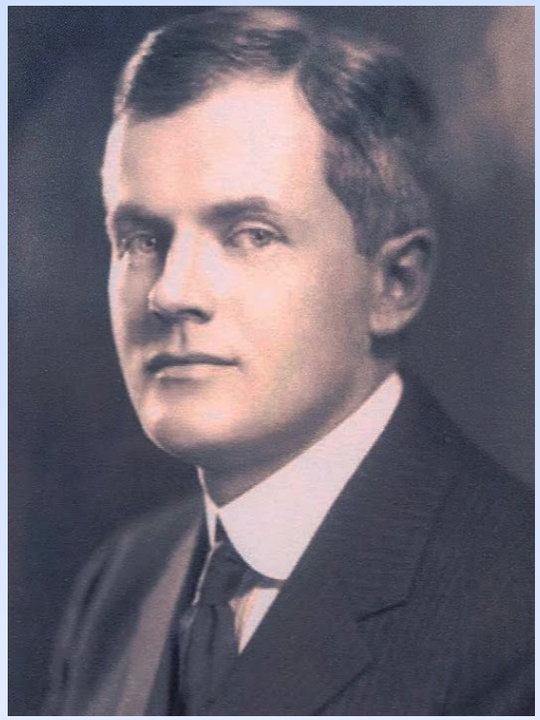
1912

41,578 train derailments **in the previous decade lead to NBS measurement and test program.**

1919

The Theory of Precipitation Hardening

Paul Merica
Metallurgy Division
National Bureau of Standards



“The early work of Merica, Waltenberg, and Scott was the first contribution to theory: it demonstrated the necessity of a solid solubility decreasing with temperature.

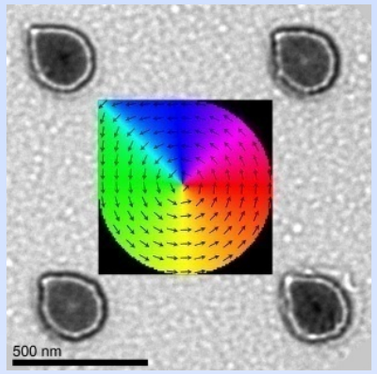
This paper had not only science but even prescience, for it suggested that some sort of precipitate-matrix interaction might contribute to hardening, long before coherency was even conceived.

There are few better examples of the immense practical importance of the theory in the history of science; before Merica no new age-hardening alloys were discovered—the worker did not know where to look; following Merica, new age-hardening alloys came in a flood.”

-- R.F. Mehl, 1959

Magnetic Materials

Nanomagnetics for Post-CMOS

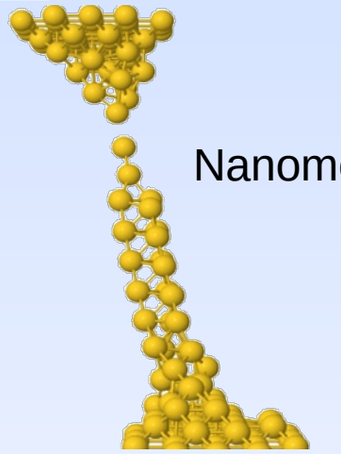


Permanent Magnets

Materials Performance

Sheet Metal Forming

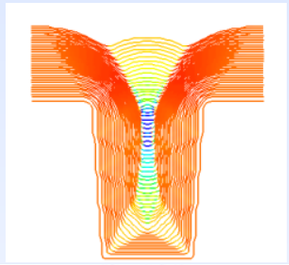
Mechanical Performance – Extreme Conditions



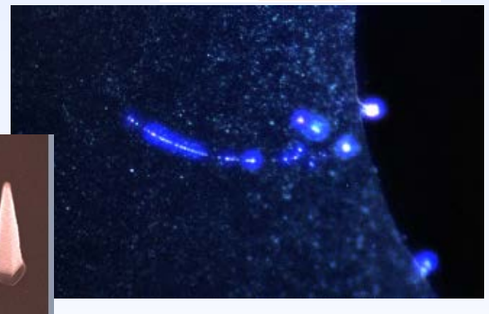
Nanomechanics: Atomistics

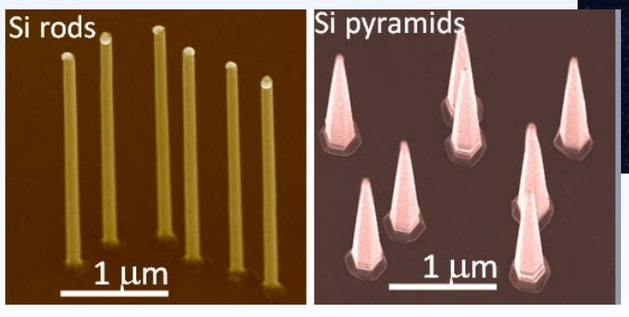
Hardness Standardization – Rockwell, Vickers, Knoop

Thin Film & Nanostructure Processing

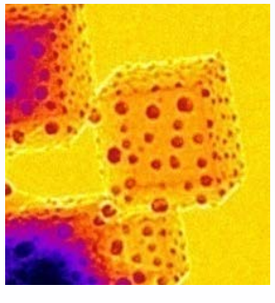


Nanostructure Fabrication Processes



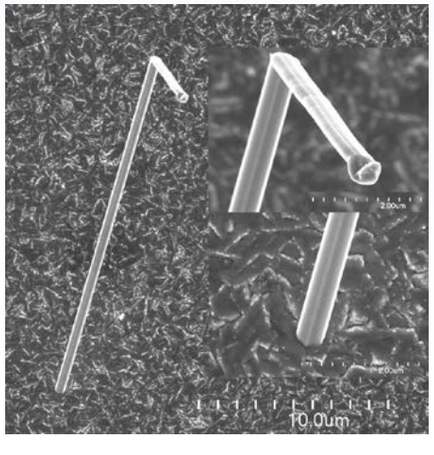


Microscopy Methods

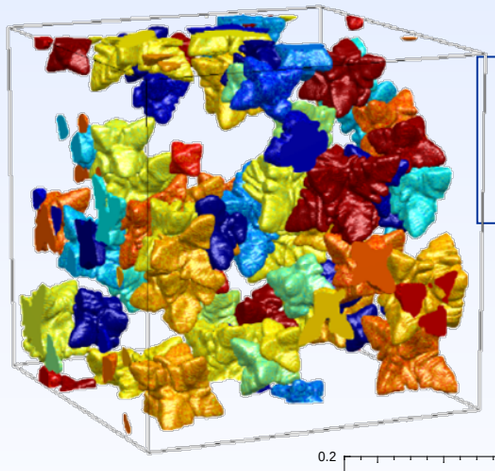


Battery Storage

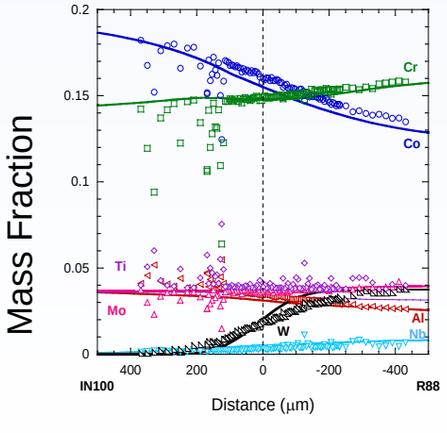
Surface & Growth Stress Measurement



Thermodynamics and Kinetics



Microstructural Modeling



Thermodynamic and Kinetic Data & Models

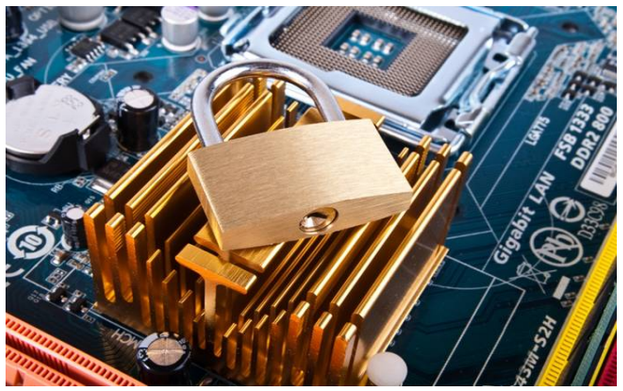
Materials Genome Initiative

Lead-free Surface Finishes, Tin Whiskers

NIST FY2012 Laboratory Program Changes (+$69.6M)

- **Tools for Manufacturing Competitiveness (+$26.8M)**
  - Advanced Manufacturing National Program Office
  - **Advanced Materials for Industry – Materials Genome Initiative**
  - Additive Manufacturing and Next Generation Robotics and Automation
  - Measurement Services and Standards to Support Biomanufacturing
  - Measurements to Support the Manufacture and Production of Nanotechnology-based Products (includes nano-EHS)

- **Measurement Services in Time, Electrical Measurements (+$3.8M)**
- **Measurements and Standards to Support Increased Energy Efficiency and Reduced Environmental Impact (+$2.5M)**
- **Measurements to Support Advanced Infrastructure Delivery and Resilience (+$2.0M)**



- **Cloud Computing and Wireless Interoperability (+$5.0M)**
- **Natl. Strategy for Trusted Identities in Cyberspace, NSTIC (+$16.5M)**
- **Cybersecurity Center of Excellence (+$10.0M)**
- **Postdoctoral Research Associateships Program (+$3.0M)**