1st Biennial Metropolitan St. Louis Grants Conference

BioFuels and BioProcessing

NIST Research and Capabilities

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Examples of NIST’s Current Fuels-Related Activities

Standards and property data for fossil fuels:
- **Real Fuels Program**: Understanding transportation fuels to determine properties and performance
- **Fossil Fuel standards**: Certified for chemical composition

Gas pipeline integrity, safety, and reliability:
Materials properties related to storage, and transport (metering)

Alcohol-fuel blends:
- Combustion characteristics,
- Droplet vaporization profiles,
- Sooting tendency as a function of composition

Properties of alternative fuels for transportation:
- Hydrogen-enriched fuels; alternative oxidizers; safer fuels
  - Data and standards for fuels and lubricants
  - Aircraft fuel tank safety – modeling fuel vapor behavior
  - Fire safety of alternative fuels.
  - Fuel-cell imaging in actively operating fuel cells
Examples of Current NIST Standards for Transportation Fuels

**Combustion Data:** chemistry (kinetics) and mixing (fluid dynamics)
**Output:** data and simulation models

**Evaluation Standards:** Reference liquids (octane rating as specified in ASTM Manual for Rating Motor, Diesel, and Aviation Fuels), Catalyst package (oxidation stability used in ASTM D 4742, Standard Test Method)

**Chemical Composition Standards:** Diesel fuel, kerosene, fossil fuels, residual fuel oil

**Instrument Calibration:** Combustion Calorimetry standards (e.g. combustion bomb calorimeters), Optical Properties standards (e.g. calibration of fluorescence spectrometers), Molecular Absorption standards (e.g. spectrophotometry)

**Calibration Services:** Hydrocarbon Liquid Flow Meter calibration, Volumetric calibrations

Alcohols and Ethers [Oxygenates] in Reference Fuels: to calibrate instruments that determine alcohol content of gasoline
Advanced Energy Initiative

Changing the way we power our automobiles:

*More Efficient Vehicles:* electric hybrid
*Hydrogen Fuel Initiative:* fuel cells

**The Biorefinery Initiative:**
Accelerating research into "cellulosic ethanol" can make it cost-competitive by 2012, offering the potential to displace up to 30% of the current US fuel use.

We must also change how we power our automobiles … fund additional research in cutting-edge methods of producing ethanol, not just from corn, but from wood chips and stalks, or switchgrass. Our goal is to make this new kind of ethanol practical and competitive within six years.

GW Bush
State of the Union Address, 2006
The Hydrogen Economy: Four Challenges

- Ensuring Fair Trade
- Storing More Hydrogen
- Creating Consensus Standards
- Making Better Fuel Cells
... and biofuels
leveraging existing expertise

DNA quantitation: for biofoods (agriculture and trade)

Advanced Isotope Ratio Measurements Identify Unique Manufacturing Process
Carbon 14 depleted in “fossil” carbon Enriched in “renewable” carbon

Biocatalysis: making chemical products from biomass

Alcohol-fuel blends: combustion characteristics, droplet vaporization profiles, sooting tendency as a function of composition

Materials Research: Pb-based solder is incompatible with E85 fuel

Database for Solder Properties with Emphasis on New Lead-free Solders Release 4.0
Structural and Functional Biology
Cold Neutrons for Biology and Technology
(NIH – NIST – 5 Univ. Partnership)

Plants

Marine Organisms

Human Tissues

Microorganisms

Function, mechanism and engineering through molecular and physical biochemistry, and computational biology

Structures from X-ray Crystallography, NMR Spectrometry, Cold Neutron Research, and Computation
NIST Embraces Partnerships

*NIST has strong relationships with:*

- **Industry**
  More than 70 Active CRADA Partners

- **Academia**
  Joint Institutes: Center for Advanced Research in Biotechnology with Univ. of MD; JILA with Univ. of CO; Hollings Marine Laboratory with the Medical Univ. of SC & College of Charleston

- **Government**
  Collaborations and/or Interagency agreements with many agencies, including DoE

~1800 Guest Scientists & Engineers
- 74% from U.S. Organizations
- 26% from Foreign Organizations

Additional 850 users of facilities
Thank you for your attention