Overview of ASTM D03 Involvement with Hydrogen Fuel Purity Specifications

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April 26, 2004

ASTM Int'l – Standard Development Activities

- www.astm.org
- 132 technical committees
- 30,00 members
  - 100 countries represented
  - 100 industry sectors represented
  - 2,200 Subcommittees
  - Thousands of task groups

ASTM Hydrogen Standards Development

- Over 20 Technical Committees have developed 287 standards related to H2
- Heavy Concentration
  - Committee D02 on Petroleum Products and Lubricants
  - Committee D03 on Gaseous Fuels
  - Committee F07 on Aerospace and Aircraft
  - Committee G02 on Corrosion

Breath of H2 Standardization

Other ASTM Committees:

- Committee D05 on Coal and Coke
- Committee D14 on Adhesives
- Committee D16 on Aromatic Hydrocarbons and Related Chemicals
- Committee D22 on Sampling & Analysis of Atmospheres
- Committee D34 on Waste Mgm't
- Committee E41 on Laboratory Apparatus
- Committee F16 on Fasteners

ASTM Committee D03 on Gaseous Fuels - Scope

- “Committed to the promotion of knowledge and the development of definitions, specifications, classifications, recommended practices, and methods of sampling, analysis and testing relating to gases used as commercial fuels including but not limited to natural gas, reformulated natural gas, hydrogen, fuel cell gases and other miscellaneous gaseous fuels”.
- Formed in 1935, meets 2X a year (June & Dec)
- ASTM D3 standards play a preeminent role in the gaseous fuels (nat gas) industry; embedded in custody transfer contracts & tariffs

Sample Stds - ASTM Committee D03 (Gaseous Fuels)

- **D1142**-Std Test Method for Water Vapor Content of Gaseous Fuels by Measurement of Dew-Point Temperature
- **D1946**-Std Test Method for Analysis of Reformed Gas by Gas Chromatography
- **D4150**-Std Terminology Re Gaseous Fuels
- **D5287**-Std Practice for Automatic Sampling of Gaseous Fuels
- **D5504**-Std Test Method for Determination of Sulfur Cpds in Nat Gas & Gaseous Fuels by GC and Chemiluminescence

ASTM D03 (continued)

- List of Subcommittees:
  - Collection & Measurement of Gaseous Samples
  - Determination of Heating Value & Relative Density
  - Determination of Special Constituents
  - Analysis of Chemical Composition
  - Thermophysical Properties
  - On-Line/At-Line Analysis
  - Hydrogen & Fuel Cells
  - Terminology Classification & Specifications

Definition of a H2 Purity Specification

- **Purpose**: provides information about the physical & chemical characteristics of H2 fuel & the pertinent test methods for evaluation
- Addresses the "full H2 fuel cycle" :
  - Production, distribution, storage and dispensing of H2 fuel
  - Vehicle H2 fuel cell system & performance issues

ASTM D3 - Objectives

- Support the concerted efforts of DOE and various standards development organizations (SDO) in addressing the safe and reliable use of H2 fuels through the development of practical codes and standards.

Key Activities

- Participate in defining H2 fuel purity guidelines (& specifications) as requirements are provided by the various stakeholders involved in the production, processing & conditioning, delivery, storage, dispensing and utilization of the H2 fuel at the fuel cell vehicle.
- Advice on existing analytical test methods that can be used as “interim” test methods for R&D and field demonstration projects.

Key Activities (cont'd)

- Develop, issue and periodically update field tested and "peer reviewed" analytical test methods and standards that can be used to address compliance with H2 purity specifications during the pre-commercial, near-commercial and fully commercial phases of the transition to H2-powered fuel cell vehicles.

Work Break Structures (WBS)

Phase 1: Pre-Commercial (R&D & demo, limited vol deployment of concept/prototype FCVs)

1. Gather reqmts from SDOs, DOE & stakeholders
2. Organize ASTM D03.14 Sub-com
3. Review existing ASTM stds re H2 applicability
4. Prepare task agreements w/ other SDO's & DOE
5. Develop "interim" Test Methodology guideline
6. Perform field validation of "interim" guideline
7. Revise/Issue "interim" guideline

Timeline: Complete task 5 by Dec '04 & task 7 by July '05

WBS (cont'd)

Phase 1 (cont'd)

8. Issue specific ASTM Test Methods w/ consideration for H2 & FC gases (as req'd – e.g., GC/MS & Test Methods for NH3, HCHO, HCOOH, Na+ & K+)
9. Solicit feedback/comnts from stakeholders
10. Update/adjust resource needs

    Timeline: On-going

WBS (cont'd)

Phase 2: Near Commercial (large vol deployment of prototype FCVs) & Phase 3: Fully Commercial (commercially available H2 fuel & FCVs)

1. Gather revised reqmts from SDOs & stakehlders
2. Prepare specific ASTM Test Methods (as req'd)
3. Perform field validation/"peer review"/lab round robin
4. Issue specific ASTM Test Methods & standards (as req'd)

   Timeline: TBD

ASTM D3 Resources

Typical D3 Sub-com & Task Force will consist of representatives from the stakeholders involved in the "full H2 fuel cycle" (production to end-use):

Fuel providers, Fuel Cell stack suppliers, FCV suppliers, H2 Reformer suppliers, H2 Dispensing Sta integrators & equipment suppliers, Fleet users (CaFCP, SunLine, ITS-Davis, etc.), Analytical Instrumentation Suppliers (Agilent, Antek, etc.), Analytical Laboratories, Industry Assoc (GTI, API, NHA, etc), Gov't agencies (SCAQMD, CARB), Academic Institutions, SDOs (liaison with SAE, CGA, ISO/JARI)

Budgetary Requirements

2004 – 2005: $50,000

- Field validation of a Test Methodology guideline document for six (6) H2 fuel supply scenarios conducted by 3 independent laboratories.
- Development of ASTM Test Methods for critical contaminants (NH3, Na & K cations)

Budgetary Reqm’ts (cont’d)

2005 – beyond : $50,000 to $75,000

Field validation and laboratory round robin tests of the use of the following:

- a new specific ASTM Test Method for GC/MS Analysis of H2-rich streams
- Modifications to existing ASTM Test Methods to include Water, Sulfur, CO2 & CO Analysis of H2-rich streams
- Development of Calibration standard gases