Gas Clean-up for Fuel Cell Applications, Argonne National Lab
Fuel (NG, LPG, LFG, ADG, APG, biodiesel) opportunities and impurity issues

Gas Cleaning for Remote SOFC Applications

Acumentrics SOFC Corporation
March 6th-7th
Acumentrics SOFC, Inc

- SOFC division established in 2000, “Powder to Power” in single facility in Westwood, MA
- Pioneered small tubular SOFC; focus on rugged fuel cells
  - Tubular SOFC →30 min startup to 750°C

**PRODUCTS:**
- 250W-10kW products,
- **250-1500W commercial** power products (NG, APG, LPG) with - 1 million+ operating hours
- 3kW and 10kW development products (biofuel, diesel, JP8) for the US military

**FUELS and APPLICATIONS**
- **Natural gas, wellhead gas, LPG, JP8, biofuel**
- **Critical remote power**
- Units utilize remote monitoring for additional reliability
Remote Power Applications Example

- US Coast Guard Radio Network Towers in Alaska
- LPG flown in by helicopter; fuel efficiency highly desirable
Sulfur Cleaning – Well head and Associated Gas

- Sulfur makeup generally unknown
- Sulfur observed as low as 1ppm H$_2$S and up to 100ppmW in some wells.
- Other contaminants? No severely debilitating species observed that are not trapped in beds (as yet...)

**Top:** Wellhead gas composition
- Measured at 3 sites in Texas in 2011

**Bottom:** Sulfur Makeup.
- Measured at 3 sites in Texas in 2011
Sulfur Cleaning - LPG

- Transient compositions
  - Typically 35ppmW but as high as 180ppmW sulfur
  - \textbf{COS}, THT, EM and higher MW species
  - Accumulation of sulfur in the bottom of the tank

\textbf{Top}: Hydrocarbon composition as LPG tank depletes

\textbf{Bottom}: Anomalous sulfur in commercial LPG as a function of depletion.
  - Measured in February 2012 in Westwood, MA
  - Similar composition encountered in Canada in April 2012
Gas Cleaning Challenge

- Associated and well head gas
  - Sulfur and gas composition varies geographically
  - Not predictable? Composition unknown?

- LPG
  - Mostly propane in US, propane and butane in other parts of the world.
  - Composition not highly defined; Odorants as well as residual sulfur
  - COS can be present in LPG and is difficult to remove.
  - Sulfur composition changes as bottle empties

- Clients do not care about sulfur! They want $aving$
  - Cost is number one driver for widespread commercial applications
  - Need to reduce maintenance cycle cost. **Reduce bed sizes and eliminate unnecessary bed changes**
  - Low cost, robust sulfur sensor would be ideal for limiting life-cycle cost