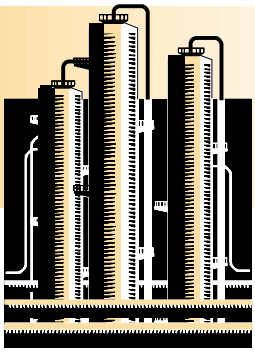
PETROLEUM

Project Fact Sheet



Micro-Gas Chromatography Controller for Petro-Chemical Application

Benefits

- Safe, reliable operation
- Increased productivity
- Reduced frequency of emergency flares
- Reduced amount of off-specification material produced
- Boosted efficiency of energy use

Applications

A micro-GC-based process controller is a viable technology in many industries including the oil and gas, hydrocarbon-processing, chemical, and semiconductor industries.

Real-Time Monitoring of Ethylene Production Can Improve Overall Process Efficiency

Ethylene is the highest volume chemical produced in the U.S. by petrochemical refineries. Over 26 million tons were produced in the U.S. in 1999, while worldwide capacity is over 92 million tons per year. The major manufacturing process used to produce ethylene is de-hydrogenation of ethane. A by-product of this reaction is acetylene, which must typically be less than 1 ppm in the final ethylene product. Acetylene removal is, therefore, a critical part of the ethylene manufacturing process.

Acetylene is usually removed by hydrogenation to ethylene or ethane, a reaction that produces heat. Inadequate control of the hydrogenation reaction can result in loss of product and feedstocks, lower unit efficiency due to re-processing of material, and in some cases, serious accidents. Control of acetylene hydrogenation requires rapid analysis of acetylene and carbon monoxide, enabling plant operators to adjust process parameters for optimum efficiency. This project will develop a micro-gas chromatograph (GC) controller capable of providing a quick (one minute versus the current 10 minute) analysis of ethane, ethylene, acetylene, and carbon monoxide concentrations or ratios in the desired process stream. The monitoring system components will also be low cost since monitoring is often required at numerous points along the refining line.

Figure 1

Conventional and Micromachined Gas Chromatograph Components.

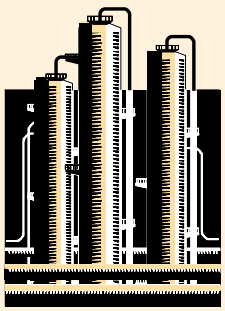
Project Description

Goal: To advance emerging micro-gas chromatograph (GC) technology in the area of refinery process control. Micro sensor technology (μChemLab™) will be modified to separate by compound the chemicals of interest and provide the system integration and control needed to operate a petrolelum refining process.

ONIX Process Analysis, Inc. (ONIX), Sandia National Laboratory (Sandia), and Phillips Petroleum Company will team up to produce the micro-GC instrumentation. ONIX will bring gas-sampling sub-systems, miniature gas-phase detectors, and expertise in data analysis to this project. Sandia, one of the leaders in the development of micro-scale GC columns, is currently developing a small, integrated process controller using a miniaturized GC column. Phillips Petroleum Company will provide the test facilities and process expertise required to develop the theory behind the process control system.

Progress and Milestones

- New channel coatings and column packings will be selected that are optimized for ethane/ethylene/acetylene/carbon monoxide separation.
- A sampling front will be integrated with the existing micro-GC for refinery process lines.
- An appropriate detector such as the micro-machined thermal conductivity or micro-flame ionization detector will be chosen.
- The micro-GC controller will require thermal and/or mechanical hardening to allow reliable operation in hostile environments.
- Communication protocols and interfaces are being developed that will facilitate connection of the controller to industry-standard or commonly-used process instrumentation.



Project Partners

ThermoONIX
Angleton, TX

Sandia National Laboratory,
Albuquerque, NM

Phillips Petroleum Company
Bartlesville, OK

For additional information, please contact:

Bob Gemmer
Office of Industrial Technologies
Phone: (202) 586-5885
Fax: (202) 586-3237
bob.gemmer@ee.doe.gov

Please send any comments, questions, or suggestions to
webmaster.oit@ee.doe.gov

Visit the OIT Web site at
www.oit.doe.gov

Office of Industrial Technologies
Energy Efficiency
and Renewable Energy
U.S. Department of Energy
Washington, D.C. 20585

OIT

December 2000