

Development of a Low-Cost Gas Leak Monitor

Description: To develop and field test an inexpensive leak monitor device that can be readily installed on inside meter sets or other confined spaces where gas pipe is present.

Status: Prototype leak monitors have been developed and are being tested for a simulated field application.

BENEFITS

Gas distribution companies are responsible for inspecting customer meter sets. To assure their integrity, meter sets require periodic leak inspections. Many meter sets are located on the inside of buildings/residences and need a gas company representative to access and inspect them, which can be costly and time consuming for some companies.

NYSEARCH, with technical development from Polytechnic University, is developing a monitoring device that will eliminate the need for meter leak inspections inside buildings. The devices being developed are designed to be low-cost, compact and rugged for field

applications.

BACKGROUND

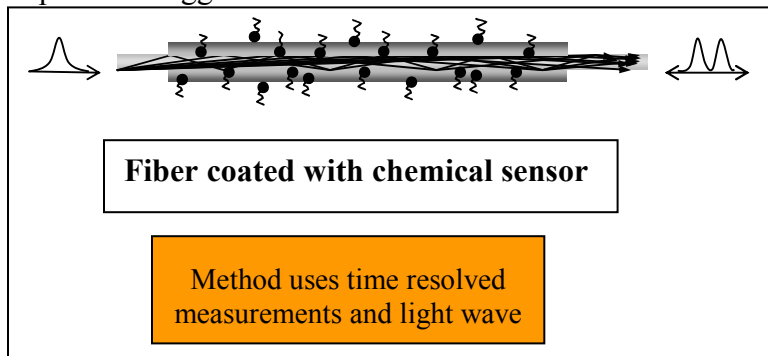
Polytechnic University has been designing and developing sensing systems for health monitoring in the civil infrastructure and the environment. Applications for these sensing systems include monitoring moisture in transport processes and tracking movements of liquid hydrocarbons in the subsurface environment. In these applications, optical wave-guides have proven to be a valuable tool for remote information gathering.

Recent advances in optical fiber wave-guide technology have helped convert bench-top optical instruments into

compact optical sensor systems. Availability of optical sensor components, such as light sources and detectors, has enabled numerous in-situ applications of chemical sensor technologies that were not previously possible. The development and application of these hybrid sensing systems have great potential for monitoring the utility infrastructure.

TECHNICAL APPROACH

Optical spectroscopy is a well established technique for characterizing gases and liquids. The approach uses a special chemical coating applied to a polymer fiber. The chemical coating has special sensor molecules that react to certain light waves. When short pulses of light are launched into the permeable optical fiber, light pulses that are traveling through a gas are uniquely altered by the presence of certain gas molecules. The location of



this event is then uniquely determined by the time resolved measurement. Time resolved measurement is also known as Optical Time of Flight (OTOF) measurement and has been used successfully in the telecommunication industry for detecting poorly spliced connections in optical fiber networks.

In the proposed system, Polytechnic University plans to take advantage of available signal processing instruments developed for the telecom industry to achieve time resolved chemical analyses along a fiber. More specifically, the objective is to develop and build a low-cost prototype sensor for detecting leaks on meter sets located inside buildings. The focus will be to determine the sensitivity, selectivity, response time and robustness of the system using optical fiber devices to monitor gas leaks in interior meter spaces or other confined spaces. The detection device is based on fluorescence spectroscopy and does not sense natural gas directly. The monitoring devices will detect changes in

a given environment. Polytechnic has shown that the use of oxygen displacement is well defined for this technology and very responsive to changes in concentration. The leak detection devices will undergo a series of tests in both a laboratory and field.

Polytechnic University has developed three prototype devices with different sensing configurations for testing. In the prototype phases, PDA devices will be used initially to capture and retrieve data. Air movement, humidity and temperature fluctuations must be evaluated to determine their affects on the detection sensitivity.

In a later task, gas utility members will test the devices in a variety of meter set configurations. Based on the success of these tests, Polytechnic plans to develop a self-contained gas leak sensor. It will be capable of detecting inside meter leaks and also will be able to either transmit an alarm on location or offsite.

PROJECT STATUS

Polytechnic has successfully completed a “proof of concept” in an earlier phase and is developing three prototype devices for lab and field testing. Simulated real-scale field tests are being developed to determine the most effective sensor type (point or distributed sensor) and the best location for device placement within a meter set environment.

HIGHLIGHTS

- Low-cost device to monitor inside meter sets.
- The device has a sensor that detects changes in oxygen levels in a given environment.
- Other gases, such as CO or CO2 can also be detected.

FOR ADDITIONAL INFORMATION

Angelo Fabiano
Technology Manager,
NYSEARCH
Northeast Gas Association
1515 Broadway, 43rd Floor
New York, NY 10036-5701
212-354-4790
Fax: 212-764-7014
afabiano@northeastgas.org

Masoud Ghandehari
Associate Professor
Polytechnic University
Six Metrotech Center
Brooklyn New York 11201
718-260-3441
masoud@poly.edu

