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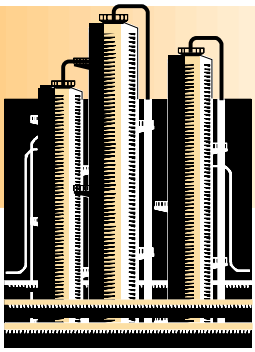
Project Fact Sheet



Assuring Mechanical Integrity of Refinery Equipment Through Global On-Stream Inspection

Benefits

- Reduced refinery downtime
- Boosted productivity
- Increase energy efficiency
- Reduced hydrocarbons released into atmosphere from refineries during shutdown processes
- Reduced potential of releases to the ground, water, and air
- Extended equipment lifetime

Applications

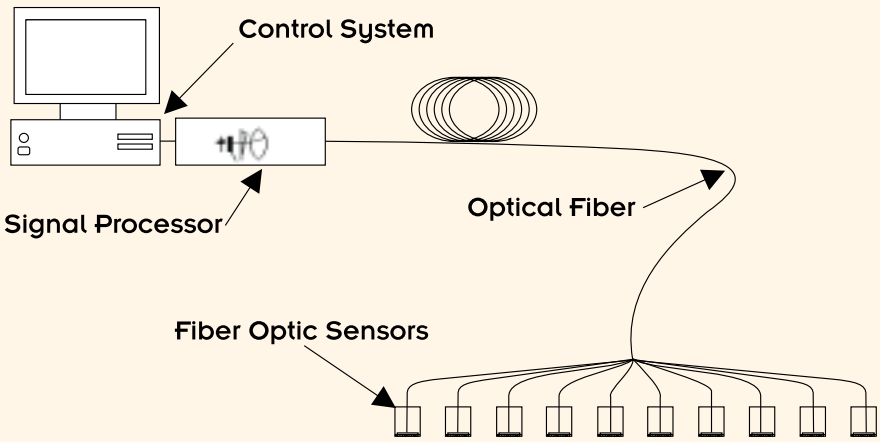
The all-optical sensing systems have the potential to replace conventional electronic instruments used to control systems in the process industries such as petroleum, refining, chemical processing, and power generation. The optical sensors are low-cost, and because they do not require electrical power, can be located in hazardous areas without the need for expensive explosion-proof containment.

Monitoring and Diagnostic Technologies in Refineries Can Minimize Downtime, Reduce Energy Use, and Boost Productivity

Refineries operate around the clock, almost 365 days a year. During continuous operation, a typical refinery uses 25 trillion Btus per 50,000 barrels processed per day. When process equipment fails, the plant must often be shutdown in order to repair or replace parts. Periodic inspections of pressure equipment also require downtime, resulting in as much as a 25 percent energy loss. Therefore, minimizing downtime is critical to maximizing the efficiency, productivity, and profitability of operations in the refining business.

This project will develop monitoring and diagnostic technologies to assure the mechanical integrity of critical equipment in refineries such as pressure vessels, piping, and furnace and boiler tubes. Technologies will detect, locate, and characterize environmental cracking of pressure vessels and piping before the possibility of catastrophic failure. For furnace and boiler tubes, new monitoring systems will measure the surface temperature of tubes experiencing ambient temperatures greater than 1800°F. All technologies will be capable of monitoring and making measurements while the refinery equipment is operating.

Figure 1.0



Fiber optic sensing system concept

Project Description

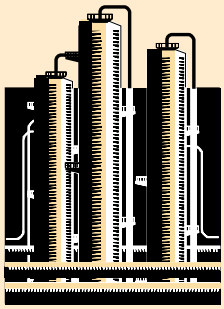
Goal: To develop on-line inspection technologies to detect, locate, and characterize environmental cracking of pressure vessels and piping and measure the surface temperature of furnaces tubes located in furnaces where the ambient temperature exceeds 1800°F.

In this project, Davidson Instruments, Inc. will consolidate a variety of fragmented programs that already exist and enable the industry to achieve its goal more quickly and assuredly than can be accomplished through the current fragmented approach. Participating groups include an Industrial Advisory Team (IAT) formed by technical and management representatives from the major U.S. oil companies (including BP, Chevron, Conoco, Exxon-Mobil, Shell, Texaco, and Sunoco), Lawrence Berkeley National Laboratory, and Ohio State University (OSU).

The proposed inspection applications to be developed in parallel are a global on-stream inspection of pressure vessels and piping and an on-stream monitoring of furnace and boiler tube technology. The first application will develop the following: 1) low-cost fiber-optic acoustic emission (AE) sensors for detection and location of cracks, 2) improved acoustic emission algorithms to reliably classify environmental cracking, and 3) high temperature ultrasonic transducers to size environmental cracks at temperatures up to 1000°F.

Progress and Milestones

- Design, fabricate, and test fiber optic based AE sensors capable of detecting environmental cracks in pressure vessels and piping.
- Optimize the AE detection and location algorithm for sensitivity to environmental cracking in pressure vessels and piping.
- Optimize the design of the high temperature ultrasonic testing system for maximum sensitivity to environmental cracking in welds.
- Design , fabricate, and test fiber optic sensors for continuous monitoring of furnace tubes that are operating at elevated temperatures.



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