Dutch High-Temperature Logging Fiber Optic System

Article Overview

High-temperature fiber-optic logging systems enable precise, distributed temperature measurements in harsh environments, offering real-time monitoring and long-term reliability beyond traditional sensors.

Overview

High-temperature logging fiber-optic systems are designed to measure temperature profiles in extreme conditions, such as deep wells, geothermal reservoirs, and industrial furnaces, where temperatures can exceed 300 ?C and even reach above 1000 ?C in specialized applications . These systems use optical fibers as linear sensors, allowing distributed temperature sensing (DTS) along the entire length of the fiber, often spanning several kilometers . Unlike conventional thermocouples, fiber-optic systems are immune to electromagnetic interference, can be multiplexed, and support remote monitoring .

Measurement Principles

The system typically relies on Raman or Brillouin optical scattering. A laser pulse is sent through the fiber, and the backscattered light is analyzed. In Raman-based DTS, the Stokes and anti-Stokes components are measured, and their intensity ratio is used to calculate the local temperature along the fiber . The position of each temperature reading is determined using Optical Time Domain Reflectometry (OTDR), which calculates the distance based on the time delay of the returning light . Some systems also use Optical Frequency Domain Reflectometry (OFDR) for high-resolution measurements over shorter distances.

Applications

These systems are widely used in downhole logging for oil, gas, and geothermal wells, where they provide continuous temperature profiles along the wellbore . They can be permanently installed behind casing or deployed temporarily for surveys. Key applications include:

o Production monitoring: Identifying gas and liquid influx, evaluating cluster efficiency, and assessing stage uniformity in horizontal wells .
o Geothermal and CO_2 injection monitoring: Measuring temperature changes to evaluate thermal conductivity and reservoir behavior .
o Industrial high-temperature monitoring: Tracking combustion efficiency in furnaces, turbines, and boilers .

Advantages

o Distributed sensing: Provides continuous temperature data along the entire fiber length, unlike point sensors.

o High spatial resolution: Typically down to 1 meter, enabling precise detection of thermal anomalies .
o Harsh environment tolerance: Can operate under high temperatures, pressures, and electromagnetic interference.
o Integration with other measurements: Can be combined with distributed acoustic sensing (DAS) and distributed strain sensing (DSS) for comprehensive downhole monitoring .
o Real-time monitoring: Supports automated workflows for production optimization, leak detection, and reservoir management .

Deployment Considerations

The fiber type, cable design, and installation method must be carefully selected based on temperature range, well depth, and environmental conditions . Permanent installations behind casing are common for long-term monitoring, while temporary deployments are used for surveys or testing. Advanced systems may include code-correlation OTDR to enhance signal-to-noise ratio and extend measurement range . In summary, Dutch high-temperature logging fiber-optic systems leverage distributed optical sensing technologies to provide reliable, high-resolution temperature monitoring in extreme environments, offering significant advantages over traditional electronic sensors in terms of durability, spatial coverage, and real-time operational insights .

Download Citation | Malaysia"s First Real-Time Fiber Optic Logging with High-Fidelity Distributed Acoustic and Temperature Survey

These results demonstrate that fiber optics represents a paradigm shift in well integrity assessment, transitioning from interpretive

Abstract Monitoring the in-situ temperature is key for the characterization of a seasonal geothermal energy storage.

In this project a multi-stage horizontal gas condensate producer within the Montney Formation was logged with Distributed Acoustic

With optical fibers used for sensing, DTS system are non-corrosive and intrinsically safe in explosive

At the heart of this system is Optiq real-time (RT) fiber-optic interpretation and analysis, which transforms

The basis is formed by suitable fibre-optic sensors in the well and an interrogation unit at surface. This thesis focuses on the

I am dedicated to deploying high-precision, long-range real-time temperature and acoustic monitoring technologies into harsh oil and

The fiber-optic telemetry allows the BHA to communicate with the logging system, which provides real-time production

fiber-optic cable construction. As the fiber-optic cable is firmly attached to the rods, these 101 dynamics influence the distributed

Distributed Fiber Optic Sensing (DFOS) systems, using coherent light pulses, detect physical characteristics such as temperature

The ability to provide reliable transmission systems in the harsh environments like high temperatures is the key driver

Distributed Temperature Sensing Technology Distributed Temperature Sensing (DTS) systems provide temperature information for

Summary At Colorado School of Mines, we are conducting a series of flow loop experiments to understand the fundamental physics

The High-fidelity Distributed Acoustic and Temperature Survey ("DAS" and "DTS") was evaluated to determine the

This expertise helps to locate and monitor geothermal installations as well as observe diverse aspects of natural and

Web: https://kalutha.co.za