Mozambique Pipeline Temperature Measurement Optical Cable Joint



Overview

We placed the proposed FBG on an energized cable joint of the power distribution grid and measured the temperature. Herein, we present the configuration of the sensor module and the measured results.

Key Takeaways

Distributed fiber optic sensing (DTS) systems enable continuous, real-time temperature monitoring along pipelines using optical cables, providing high-resolution data over tens of kilometers.

Overview of DTS Technology

Distributed Temperature Sensing (DTS) systems use standard fiber optic cables as linear temperature sensors to monitor pipelines in real time. The technology relies on Raman or Brillouin optical scattering, where a laser pulse is sent through the fiber and the backscattered light is analyzed to determine temperature along the cable length. The position of each temperature reading is derived from the time delay of the returning light, similar to radar echo analysis, a method known as Optical Time Domain Reflectometry (OTDR).

Optical Frequency Domain Reflectometry (OFDR) is a mathematically equivalent alternative, often used for shorter distances or higher resolution applications.

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Cable Design and Installation

For pipeline applications, outdoor-rated or armored optical cables are typically used to withstand environmental hazards such as soil pressure, rodents, and mechanical stress. Steel tape armored cables or dual-jacket all-dielectric cables are recommended for direct burial, providing both mechanical protection and high tensile strength while maintaining sensitivity to temperature changes. Proper installation ensures accurate temperature readings without compromising the fiber's ability to detect thermal variations.

Measurement Capabilities

Modern DT

S systems can monitor pipelines over distances exceeding 50 km from a single interrogator, with some systems extending up to 300 km using optical amplifiers. Temperature resolution can reach one meter spatially, allowing precise detection of hot spots, leaks, or abnormal thermal events along the pipeline. Advanced systems, such as enhanced DTS (eDTS), integrate Distributed Acoustic Sensing (DAS) to detect both temperature changes and acoustic anomalies, improving pipeline safety and operational efficiency.

Applications in Pipeline MonitoringDTS systems are widely used in oil and gas pipelines, including natural gas and brine pipelines, for: Leak detection by identifying localized temperature anomaliesOperational monitoring to verify flow and prevent overheatingStructural assessment in areas prone to landslides or mechanical stressLong-distance monitoring without the need for multiple sensors or power sources along the pipeline AdvantagesContinuous, real-time monitoring along the entire pipeline lengthHigh spatial resolution for early detection of leaks or hot spotsResistance to electromagnetic interference and corrosionIntegration with advanced analytics, including deep neural networks for rapid data processing and event classification In summary, the Mozambique pipeline can leverage distributed fiber optic temperature measurement systems to achieve robust, long-range, and high-resolution monitoring, enhancing safety, operational efficiency, and early detection of potential issues along the pipeline.

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Article Content

Temperature monitoring techniques of power cable joints in

We placed the proposed FBG on an energized cable joint of the power distribution grid and measured the temperature. Herein, we present the configuration of the sensor module and the measured results.

Temperature monitoring techniques of power cable joints in

This study proposed a sensor module that can monitor the temperature of the power cable joint using a fiber optic sensor. The advantage of using fiber optic sensors is that they are not

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The proposed cable temperature measurement system is based on placing NTC thermistors along the cable, with flexible spacing that can be adapted to the specific monitoring

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Distributed Temperature Sensing (DTS) | AP Sensing

Distributed Temperature Sensing (DTS) systems provide temperature information for accurate thermal monitoring, fire detection, and condition assessment by utilizing standard fiber optic cables.

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A fiber optic cable is used as a distributed temperature sensing (DTS) transducer for temperature profile measurements in a protective underground duct in which a high voltage (HV)...

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Advanced Cable Monitoring Techniques For Earlier Failure Warning

The initial applications of distributed temperature sensing, using standard telecommunications fibre, have enabled utilities to monitor the temperature on critical cable links, pinpointing cable hotspots

OFDR DISTRIBUTED TEMPERATURE AND STRAIN MEASUREMENTS WITH OPTICAL

Optical fibre distributed temperature measurements were then successfully compared to thermocouple reference measurements, whereas optical sensing cable data were processed to provide distributed

(PDF) OFDR Distributed Temperature and Strain Measurements with Optical ...

PDF | On Jul 8, 2014, Laurent Maurin and others published OFDR Distributed Temperature and Strain Measurements with Optical Fibre Sensing Cables: Application to Drain Pipeline Monitoring in a ...

Leakage detection using fiber optics distributed temperature ...

The present paper presents and discusses the possibility to actively and automatically monitor leakages using distributed fiber optics sensing techniques. The second part of the paper focuses on a practical

Fiber Optic Distributed Temperature Sensing | US EPA

Abstract: Raman spectra distributed temperature sensing (DTS) by fiber-optic cables has recently shown considerable promise for the measuring and monitoring of surface and near-surface

Fibre optic sensing for sensitive pipeline, concrete, and subsea cable ...

Fibre optic sensing for sensitive pipeline, concrete, and subsea cable applications The use of distributed sensing (DS) is on the rise, especially for sensitive oil and gas and pipeline

Conductor temperature monitoring system in underground power ...

A conductor temperature monitoring system using the current method was developed to estimate conductor temperatures at joints of extra-high-voltage (EHV) underground power transmission XLPE

Pipeline safety monitoring technology based on FBG-ROTDR joint

In order to verify the joint system, one leakage model of PVC pipe is established, and multi-point fiber Bragg grating strings and optical fibers are arranged on the PVC pipe for

FIBER OPTIC CONNECTOR TECHNOLOGY RELIABILITY

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Umbilical cables can easily reach lengths of 10-15 km, while pipeline cables, used for sensing, can extend to 40 km. Optical fibers also make superior distributed sensors. Changes in pressure or

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