

Tunnel Distributed Fiber Optic Humidity Sensor



Article Overview

Distributed fiber optic sensors (DFOS) can be adapted to monitor humidity in tunnels, providing continuous, real-time environmental data along the entire tunnel length.

Overview of DFOS in Tunnels

Distributed fiber optic sensors (DFOS) are widely used in tunnel monitoring to measure strain, temperature, and environmental conditions over long distances with high spatial resolution . These sensors rely on Brillouin or Rayleigh scattering principles, where changes in the optical properties of the fiber correspond to variations in physical parameters such as strain, temperature, or humidity . By embedding or attaching the fiber along the tunnel lining, DFOS provides continuous, spatiotemporal monitoring, enabling early detection of structural or environmental anomalies .

Humidity Sensing with DFOS

While DFOS is traditionally used for strain and temperature, it can be adapted for humidity monitoring by using specialized fiber coatings or hygroscopic materials that respond to moisture. Changes in humidity alter the fiber's refractive index or induce strain in the coating, which can then be detected through Brillouin Optical Time-Domain Analysis (BOTDA) or similar techniques . This allows for distributed humidity measurements along the tunnel, rather than relying on discrete point sensors....

Article Content

Jul 13, 2026

A Distributed Fibre Optic Sensing System for Humidity Measurement

A novel multi-point distributed humidity sensing system has been constructed based on the principle of using the absorption

Jun 10, 2026

Distributed fiber optic sensors for tunnel monitoring: A state-of-the ...

Distributed fiber optic sensors (DFOSs) possess the capability to measure strain and temperature variations over

Oct 23, 2025

Design of a distributed optical fiber sensor system for measuring ...

For this sensor scheme the transfer relation from fiber strain to joint deformation is derived and verified by in-lab

Jan 15, 2026

A fully distributed fiber optic sensor for simultaneous relative ...

A distributed fiber-optic sensor for simultaneous relative humidity (RH) and temperature measurement is proposed

Apr 20, 2026

Fully distributed optical fiber sensor for water and humidity monitoring

In this work, a simple optical fiber-based sensor for fully distributed water monitoring has been demonstrated and

Mar 27, 2026

Optical fibre-based sensor technology for humidity and moisture ...

Abstract Humidity and moisture sensing is becoming increasingly important in industry and through a wide spectrum of

Feb 03, 2026

Review of Optical Humidity Sensors

Optical humidity sensors have evolved through decades of research and development, constantly adapting to new

Dec 25, 2025

Fully Distributed Multi-Channel Fiber-Optic Sensor for Simultaneous ...

In this study, a distributed multi-channel fiber-optic sensor for simultaneous measurement of relative humidity (RH) and

May 16, 2026

Fiber Optics Technology for Temperature and Humidity Sensor

This chapter reviews optical fiber sensors designed for measuring temperature and humidity, covering their

Jun 11, 2026

Distributed Fiberoptic Sensor for Simultaneous Humidity and ...

Abstract: Along temperature, humidity is one of the principal environmental factors that plays an important role in

Dec 26, 2025

A Relative Humidity Sensor Based on Non-Adiabatic Tapered Optical Fiber ...

A humidity and temperature optical fiber sensor based on a long-period grating (LPG), which can provide simultaneous

Apr 16, 2026

Advanced Research and Engineering Application of

Firstly, this manuscript systematically sorts out the development and evolution process of

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Distributed Fiberoptic Sensor for Simultaneous Humidity

The sensor uses dual sensing fiber configuration for mutual decoupling and simultaneous

Apr 24, 2026

A fully distributed fibre optic sensor for relative humidity ...

In this paper we describe the characteristics of a 64-m-long distributed relative humidity sensor with cm spatial

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A fully distributed fibre optic sensor for relative humidity ...

A distributed fiber-optic sensor for simultaneous relative humidity (RH) and temperature measurement is proposed and

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Distributed fiber optic sensors for tunnel monitoring: A state-of-the ...

Distributed fiber optic sensors (DFOSs) possess the capability to measure strain and temperature variations over long distances,

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Distributed humidity sensing via optical fibers with specialty acrylate ...

Specialty hydrophilic, UV-curable acrylate coatings were engineered to enable distributed humidity sensing through

Jan 20, 2026

Distributed Fiber Optic Sensing | OptaSense

Discover monitoring solutions utilizing distributed fiber optic sensing technology and real-time applications

Aug 08, 2025

Distributed fiber optic sensors for tunnel monitoring: A state-of-the ...

Addressing the spatial limitation is crucial for the optimization of conventional tunnel monitoring, and the distributed

Sep 24, 2025

Optical fiber humidity sensor based on a tapered fiber coated with ...

An optical fiber humidity sensor (OFHS) has been fabricated using a hydrophilic gel (agarose) deposited on the

Jul 04, 2026

TUNNEL TEMPERATURE AND HOTSPOT MONITORING

KILOMETERS FIBRE OPTIC DISTRIBUTED TEMPERATURE SENSORS FOR MONITORING POWER TUNNELS, RAILWAY

Dec 18, 2025

Distributed fiber optic sensors for tunnel monitoring: A state-of-the ...

These four issues are comprehensively discussed, and practical suggestions are provided for the implementation of DFOS in tunnel

May 30, 2026

Multi-channel fiber optic dew and humidity sensor

In this article, we introduce a multi-channel fiber optic dew and humidity sensor which works using a novel method

Aug 12, 2025

Fully distributed optical fiber sensor for humidity monitoring at high ...

Previously, a fully distributed optical fiber sensor for water and humidity monitoring has been demonstrated, consisting

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