Simulate Different Environments TDLAS On the Analysis of the Test Signal Strength

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Abstract:
TDLAS system is the use of the wavelength tuning characteristics of the laser diode, for detecting the absorption spectrum of the gas absorption line. Detecting the gas space, temperature, pressure and flow rate and concentration. The use of laboratory techniques TDLAS gas detection, experimental simulation engine combustion water vapor and smoke. using an optical lens system receives the signal acquisition and signal interference test analysis. Analog water vapor and smoke in two different environments in the sample pool interference. In both experiments environmental interference gas absorption in the optical signal acquisition, signal amplitude variation analysis, and records related to the signal data. In order to study site conditions in the engine combustion process for signal acquisition provides an ideal experimental data.

Keywords: TDLAS Gas Detection Signal Analysis

Introduction
TDLAS system is the use of the wavelength tuning characteristics of the laser diode, for detecting the absorption spectrum of the gas absorption line. Detecting the gas space, temperature, pressure and flow rate and concentration. Laboratory for the one-dimensional monitoring system, using different wavelengths laser of combustion gas composition different from the relevant principles of absorption lines to monitor the test gases.

Related simulations for engine combustion products, Monitoring water vapor and smoke simulated environmental interference. Simultaneous monitoring of two types of environmental interference experiments, collecting light signals. Using the signal amplitude of the data collected for analysis processing. Laboratory simulation environment to ensure that the interference effect close to the real environmental interference effects.

1 System components
Use TDLAS one-dimensional combustion gas detection system. System uses a lens to focus the optical signal receiving mode on the detector.Detection system consists of a laser, beam combiner, collimator lens combiner, lens, the detector components. Finally, the optical signal is converted into an electric signal detection .Implemented in a computer in real-time temperature monitoring. (Figure 1)
2、Select System

Detection system consists of a laser, beam combiner, collimator lens combiner, lens, the detector components.

Laser: Infrared laser as a light source, in response to clear, interference, and high stability. Laser wavelength 1391nm, coordinated range of less than 1nm. Meet the target gas spectral response range.

Beam combiner: Combined into a two-wavelength laser beam, can increase the spectral detection range.

Collimator lens combiner: The light emitted by the laser is parallel transformation.

Lens: The light passing through the combustion field deflection focusing.

Detector: After receiving the optical signal is converted into an electrical output.

According to the above components combined to form a complete optical path monitoring system. [3] Before the experiment began, According to the experimental device for installation and calibration. Laser emits infrared laser beam, through the combustion field, Converged through the lens into the detector. At this point calibration is complete.

3、Load environmental interference sources

TDLAS monitoring system calibration is completed, Environmental disturbance on the overall system to test the ability of the system to resist harsh environments. [4] The receiving acquisition optical signal into an electric signal, using computer software “labview” to convert an electrical signal strength.

Therefore, environmental interference in the gas monitoring system. Analog produced during combustion substances. Increase the mist and smoke as environmental interference, Receiving the detected ambient interference light signal during.

First, the experimental environment for signal detection Ideally, finally detecting environmental conditions of the steam and smoke detection. Comparative analysis of the three environment types of signal data. (Figure 2~6)
Figure 3   Reference signal amplitude

Figure 4   Water vapor liquid field system

Figure 5   Combustion fumes field
Figure 6   Combustion fumes field signal amplitude

According to Fig 1-6. For TDLAS gas detection increased environmental interference of water vapor and smoke and the ideal environment to compare the reference. The receiving acquisition optical signal into an electric signal, using computer software “labview” to convert an electrical signal strength. By increasing the sawtooth signal processing in the computer to get the voltage curve. The purpose is to detect the gas absorption region for signal amplification, more accurate processing the voltage amplitude.

4、 Experimental signal analysis

Through the above experiments loaded water vapor and fumes interference. In the system of the reference light path (Ideal environment without interference). Ideally, the amplitude of the voltage is 5v. Such a signal as a reference in the laboratory, data results are satisfactory, without any impurity gas interference. detector itself noise 0.2v. In the test experiments, the gas environment photoelectric signal acquisition value better. Detection of amplitude greater than the detector noise values, Meet the practical working conditions environment.

Load water vapor interference environment, test data voltage is lower than the reference value. Voltage signal is 0.4V. The reason for this phenomenon is in the process of the mist jet, Small droplets are uniformly distributed in the combustion field space, Laser through small droplets will produce the phenomenon of refraction, such refraction causes the laser energy is dissipated in the dissemination. [5] Optical signals into the detector to reduce the amplitude range. Therefore, computer display signal value is less than the reference value.

Load smoke environmental interference, is environmental interference signal value of the minimum. test value is below the reference value and the value of water vapor interference. amplitude of the signal strength is 0.2V. The reason for this phenomenon is the experimental smoke particles in the combustion field volatile aggregation, light scattering effects in contact with smog formation. [6] Light passing through a sharp decline in the smoke. Part of the energy transmitted through space scattering weakened. Therefore, the detector receives very little light signal. Computer processing transform low amplitude Electric signal.

So far, the simulation of complex environmental interference gas detection. Simulation engine combustion process two substances. By recording data analysis assay to improve the overall value of the optical detection system. Through the gas detection data collection, Signal detection engine combustion gas as a reference and calibration.

5. Conclusion

In this paper, the simulated field study combustion engine combustion Produce water vapor and smoke signal processing and analysis. Build a lens receiving system. Focusing the light onto the detector signal acquisition.
Photoelectric signal conversion and displayed in the computer. Engine combustion experiments provide the theoretical value of the measurement signal acquisition. Thus, the study of the combustion engine Gas combustion detection to provide experimental data signal acquisition theoretical value.

References


