

# Oil oxidation in biogas engines

## Summary Information

- Oil oxidation in the range from 0–40 A/cm
- Correlates to ASTM D7414 and D7214
- Uses Mid-Infrared Spectroscopy

## Product Description

The IR Sphinx spectrometer measure the mid-infrared spectrum of a sample and extract relevant parameters. The spectrometers do not contain any moving parts but use a solid state dispersion element in combination with black body infrared emitters to measure the infrared spectrum of a sample. This results in a unique product which is robust, battery operated and weighs less than 0.5 kg. The spectrometer can be configured to measure from 2.5  $\mu\text{m}$ -5.0  $\mu\text{m}$  or from 5.5  $\mu\text{m}$ -11.0  $\mu\text{m}$ . The IR Sphinx spectrometer come with a sophisticated but user friendly software called Sphinx Suite. The software is modular and the user can choose from a number of different software modules. The software is compatible with many common operating systems.

## Application

As the oil oxidizes, its ability to lubricate diminishes and in extreme cases changes in colour (oil gets darker) and smell can occur. In addition undesired side products such as varnishes, lacquers and resins are formed and a rapid increase in viscosity can be observed. The chemical reaction between oxygen and lubricant molecules at room temperature is slow and oxidative degradation is not critical at low temperatures. However inside a combustion engine the temperatures are a lot higher resulting in an increased risk of base oil oxidation as the rate of oxidation doubles for every 10° C increase in operating temperature.

Infrared spectroscopy is very well placed to detect the oxidation of the base oil as the oxidation process in the oil results in an absorption peak at 1710  $\text{cm}^{-1}$ . The changes in absorption at 1710  $\text{cm}^{-1}$  are clearly visible in the infrared absorption spectra of a typical biogas engine oil. In order to get a good understanding of the current condition of the engine oil the degree of oil oxidation should be analysed in combination with Total Acid Number and i-pH value of the oil.

## How to use

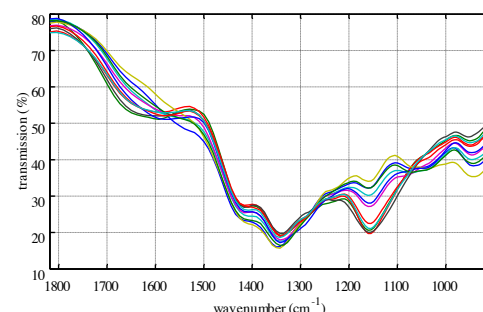
The IR Sphinx spectrometer enable the user to quickly measure the oxidation level of an oil sample. Depending on the product range the measurement is carried out in a slightly different way. For the IR Sphinx ATR products the oil sample placed on top of the ATR crystal making sure that the entire crystal is covered by the oil.

For the IR Sphinx transmission products the oil sample has to be present in the sample chamber. The transmission systems are best suited for inline measurement where the oil sample is delivered to the sample holder via a pumping system. Alternatively a syringe can be used to deliver the sample to the sample holder.

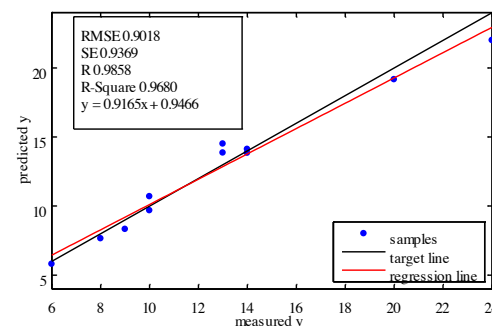
Once the sample is in place the measurement is started from the software. After about 30s the analysis of the sample is available.



## Results & Performance



Mid-infrared absorption spectra of a typical biogas engine oil at different points during the lifetime of the oil. Note the visible changes in the spectra which are related to specific oil degradation effects.



The oil oxidation has been calculated from the measured absorption spectra using the SphinxSuite software module. The plot compares the oil oxidation levels obtained from analysing the mid-infrared absorption spectra to the oxidation levels obtained of the same oil sample in accredited oil analysis laboratory. The correlation between the results is exceptional.