Pathlength reproducibility

Stability in pathlength repeatability allows the Pearl™ to be used in the accurate study of liquids.

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FTIR SPECTROSCOPY IS AN IDEAL analytical technique to characterise new, used and diluted motor oils, as well as various other hydrocarbons.

IR spectral analysis can help determine which contaminants are present, as well as what kind of chemical degradation occurs in the oil.

Traditionally, a vertically mounted cell was always the standard method of loading viscous or sticky fluids, which posed many problems including sample introduction and clean up.

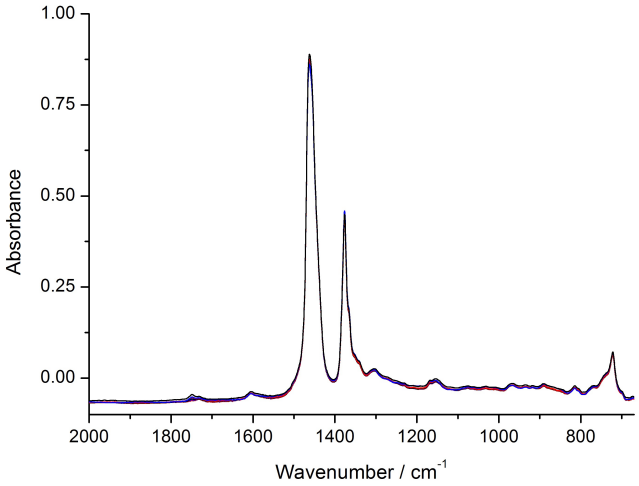
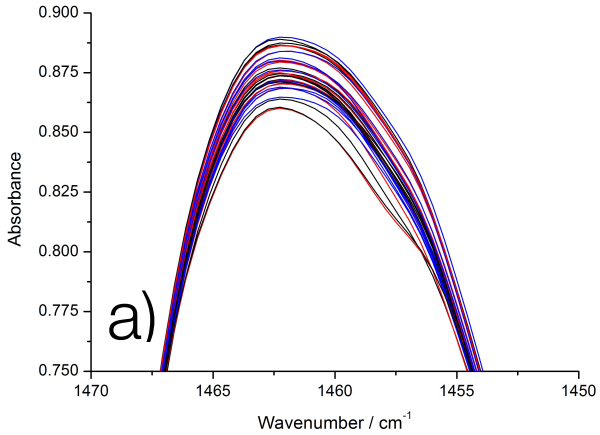


Figure 1: Spectra of 28 oil samples recorded using a 25 µm Oyster Cell

However, the Pearl™ liquid transmission accessory is designed to make the IR spectral measurement of liquids quick, easy and highly repeatable.



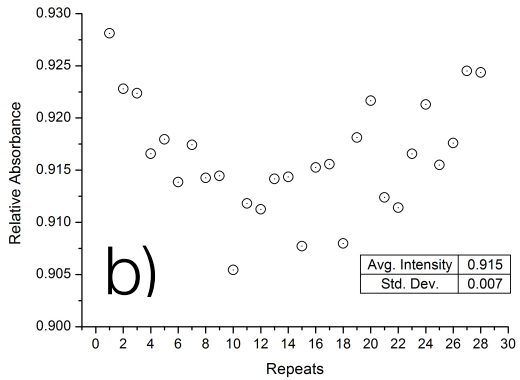


Figure 2: (a) Absorption band at 1460cm^{-1} for all 28 spectra (b) Spread of intensities relative to the baseline

This note demonstrates the repeatability of a 25 µm pathlength cell, called an Oyster Cell, comprising ZnSe windows. More information on the Oyster Cell can be found at **www.specac.com**

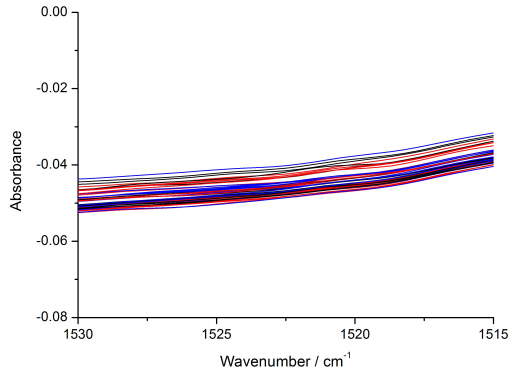


Figure 3. Variation in baseline of spectra shown in Fig. 1

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"Highly repeatable pathlengths"

Results & discussion

Figure 1 shows 28 absorption spectra of 5 µl of Renolin CL37 oil recorded using a 25 µm pathlength ZnSe wedged window cell.

The spectra are shown again in Figure 2(a), focusing on the absorption band at 1460 cm^{-1}.

The relative absorbance intensity was used rather than the absolute absorbance to remove the variation in the baseline, shown in Figure 3, which was determined to be on the order of 0.01.

Therefore, the variation in the relative absorbance intensity is used to determine the standard deviation, Figure 2(b). This allows us to determine the reproducibility of the 25 µm cell pathlength.

The variation in the spectrometer itself was measured by recording 10 spectra of an empty cell.

It was determined to be on the order of 0.001 and hence relatively negligible. The relationship between the absorbance of a cell and the pathlength is linear.

Based on Figure 2, there is standard deviation of 0.77 of the average absorbance. This correlates to a 0.2 µm error in the pathlength of the cell.

Conclusions

The stability in pathlength repeatability, demonstrated in this note, enables the Pearl to be used in quantitative studies of liquid samples with a high degree of accuracy.

Based on the internal manufacturing process and controls used in the construction of the Pearl and the Oyster Liquid Cell, we can assume that a standard deviation of 0.2 µm would be constant across the wide range of pathlengths available.

Further examples of pathlength reproducibility are planned to further validate this capability.

And similar studies are being performed for even more viscous samples such as greases and honey.

The variation in the pathlength should be the same for both ZnSe and CaF_2 windows.

Email **sales@specac.com** or visit **www.specac.com** for more information or a free demonstration. Other application notes are available on the Specac website.