

# Application Note

## Spectro FTIR Oil Analyzer



Spectro FTIR Oil Analyzer with Autosampler

The Spectro FT-IR Oil Analyzer is specifically designed for the molecular analysis of lubricating oil to determine oil degradation and contamination. It was developed and optimized for predictive maintenance programs according to JOAP and DIN standards for the rapid determination of oxidation, nitration, sulfation, water, coolant, fuel dilution, soot and wear additive depletion in used lubricating oils.

The Spectro-FTIR Oil Analyzer also provides quantitative TBN analysis (in mgKOH/g) for mineral based engine oils and TAN analysis (in mgKOH/g) for polyol ester based synthetic turbine fluids.

When purchased as a manual system, it features a patent-pending flip-top sampling cell designed for easy and reliable sample introduction, analysis and cell cleaning without the need for solvents.



Spectro FTIR Alpha

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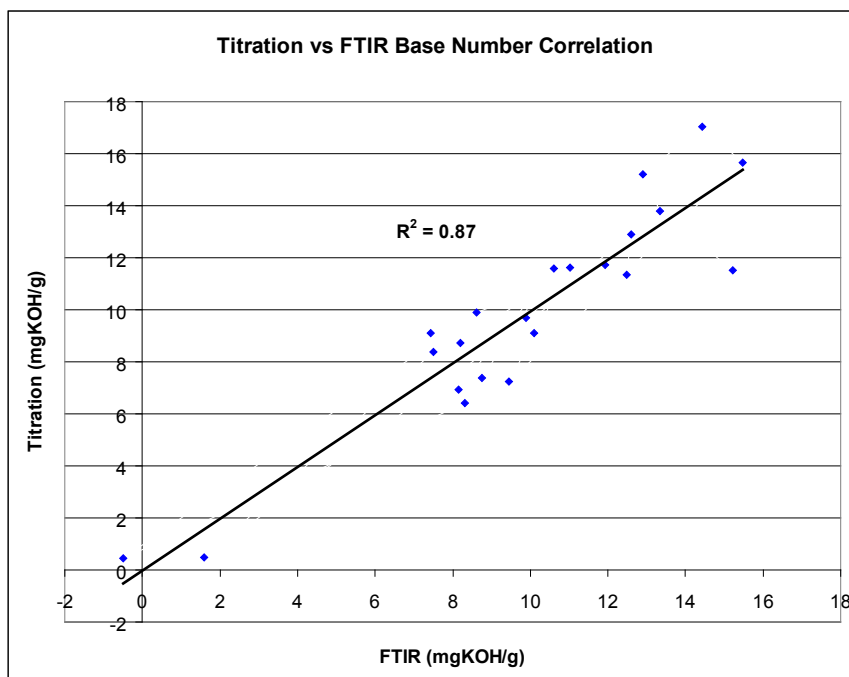
[www.SpectroInc.com](http://www.SpectroInc.com)

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## Spectro FTIR Oil Analyzer TBN Performance versus ASTM D4739 Potentiometric Titration

### Introduction

A Total Base Number (TBN) correlation study for a series of 22 engine lube oil samples was determined using a potentiometric titration versus an established chemometric calibration using an FTIR spectrometer. The samples used in the test set were a mixture of both used and new oils and the TBN values ranged from approximately 0.5 to 18mg KOH/g. The samples were analyzed on a Spectro's FTIR Oil Analyzer using ASTM E2412 acquisition parameters specified for used oil analysis. These oils were analyzed using Spectro's patent pending flip-top sampling cell together with a 695 data point chemometric regression algorithm that was adapted for use with the Spectro FTIR Oil Analysis software program. The potentiometric TBN data was obtained by strictly following the wet chemical method of ASTM D4739.



### Results

The results showed an 87% correlation between potentiometric TBN titration and chemometrically derived FTIR TBN data. If a 99% confidence interval is assumed for this data we can expect FTIR TBN values to be within  $\pm 3$  mg KOH/g compared to laboratory potentiometric titration techniques that follow ASTM D4739.

However, it should be noted that inter-laboratory reproducibility detailed in ASTM D4739 reports only 21.1% reproducibility. Thus a substantial portion can be attributed to the high D4739 error. The repeatability of the TBN regression algorithm on the FTIR for a used sample was calculated at 0.37 % RSD for a 99% confidence interval. This is considerably better (lower) repeatability than ASTM D4739.

## Conclusion

Based on superior precision compared to laboratory titrations and the reasonable correlation to existing chemical titration methods, it has been demonstrated that the Spectro FTIR Oil Analyzer can be used to accurately evaluate TBN in used mineral oil based lubricants across a wide TBN range.

The robust chemometric technique coupled with the FTIR flip-top cell ensures that data are both accurate and repeatable and reported relatively quickly, within 2 minutes. Clean up for the next sample is quick and easy and the method does not require large volumes of hazardous solvents and titrants as do traditional laboratory titrations.

The chemometric calibration algorithm for TBN using the Spectro FTIR Oil Analyzer can be used to quickly and accurately quantify when a used engine oil is degrading compared to the current method in E2412 which uses basic oxidation, nitration and sulfation peaks as degradation indicators.

