INFRARED ANALYSIS

Infrared analysis has been employed as an analytical technique for many years, with respect to monitoring used lubes, its application was highly limited by:

- A need for a reference sample (usually a new sample of lube being analyzed)
- Opacity of the sample
- Lack of sufficiently sophisticated instrumentation
- Corresponding costs to obtain trustworthy data

The above objections could be partially overcome. The analyzing facility limited its scope to only a few products or base materials, such as an individual lube formulator analyzing only his/her own products. The technology today, however, is now available to transcend the limitations above and is offered as a routine service.

WHAT IS INFRARED?

IR is one of numerous spectrometric techniques for analyzing the chemistry of materials. In all cases "spectrometric" analysis implies a measurement of a very specific wavelength of light energy, either in terms of amount absorbed by the sample the question or the amount emitted from the sample when suitably energized.

IR is an absorption form of spectrometric analysis. Unlike atomic absorption, IR is not concerned with specific elements (lead, copper, etc.) but rather with the grouping of atoms in specific combinations to form what are called "functional groups". These various functional groups help to determine a materials properties or expected behavior.

By knowing which wavelengths are absorbed by each functional group of interest, one can cause the appropriate wavelength to be directed at the sample being analyzed and measure the amount of energy absorbed by the sample. The more energy absorbed, the more of that particular functional exists in the sample. Results can therefore be numerically quantified. The units of measurement are usually expressed as "Absorbance Units".

HOW DOES IR APPLY TO LUBE ANALYSIS?

It is useful for the layman to treat infrared analysis as the chemistry of Carbon, Hydrogen, Oxygen, Nitrogen and Sulfur and the various combinations in which these elements configure or attach themselves. By identifying and quantifying certain functional groups one can derive highly dependable information about the lube, whether new or used. This includes, but is not limited to:

BASIC PHYSICAL COMPOSITION
Most lubes consist of two major components, base stock and additive. It is possible to distinguish between differing base stocks with IR for the purpose of quality control. The feature is particularly useful for assurance that a synthetic lube is not being inadvertently contaminated with mineral oil, thereby impairing the synthetic's beneficial properties.

ADDITIVE CHEMISTRY
This is part of the routine infrared inspection. It can determine if the lubes contain additives and if the additives are effective. This is not a difficult process provided the lab is familiar with the product being tested. In most instances the question of specific additive depletion can be answered.

CONTAMINATION
IR is particularly useful for detecting oxidation products. Such products are detrimental to good lubrication if present in significant quantity. It is also sensitive to coolant contamination (water or glycol).
Manufacturing plants that produce certain types of chemicals that may be introduced into the lube system would be able to detect the presence of these contaminates as they accumulated in the lube.

LUBE DEGRADATION
Oxidation is developed from varying combinations of heat, air and lube agitation, this is usually characterized by lube thickening. The IR test determines the amount of oxidation present in the sample tested. Nitration and Sulfation determinations are used to detect the build-up of potentially corrosive Nitric and Sulfuric acids.

IR APPLICATION SUMMARY

Many laboratories try to determine the amount of additive or additive depletion by measuring the amount of additive metals present in the oil. While the tests used to determine these metals are easily performed, they can be misleading. Additive metals can easily fluctuate +20% to –20% as a normal circumstance. Also, many of the same metals that are present in the additives are also present in components within a unit (Magnesium is also present in small amounts in aluminum alloys). Therefore, it is possible to have a loss of an additive metal and a secondary gain from an internal component and not see the actual additive metal loss. It is also possible for a wide variety and quantity of additives to be used to meet the same specification for an oil.

Therefore, the level of a metal detected to determine an additive does not necessarily reflect the usefulness of that additive in the oil. Infrared analysis is the most accepted test method in the industry today to determine the condition of lubes. The method looks at both the additives in the oil and the actual condition of the oil itself. This method gives a true and complete analysis of the lubricant in a way that no other test can duplicate.