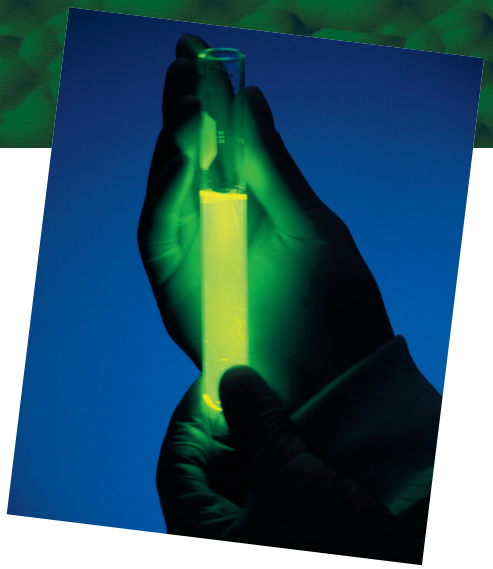
Survey of fluid analysis systems

by Jack Poley



We continue our listing and discussion of large particle analytical systems for fluid analysis. Though particle counting and ferrography have been the primary platforms for such analyses for a number of decades, there has also been ongoing development of corollary and new techniques by instrument manufacturers, as the maintenance community continues to upgrade its expectations, identifying increasingly specific needs.

Particle Quantifying Analysis. This is a magnetic technique similar in concept to direct-reading ferrography but providing a somewhat different analytical yield, a single scalar value called the PQ Index based on ferro-magnetic debris.

Micropatch. This approach, used for decades but probably not often enough, emulates analytical ferrography in that a microscope is utilized to view particles trapped on a fine filter after the sample has been solvent-diluted and vacuum-passed through the filter, leaving particles greater than the nominal pore size of the filter. Absolute filters as small as 0.8 or 0.47 micrometers are typically utilized.

There is, of course, no systematic particulate orientation but, on the other hand, *all* particles of interest are trapped for view. Even analytical ferrography can't make that claim. Further, the magnetic tendency of the filtered particles, therefore a rough estimate of the amount of iron or steel deposited, is discernible with a small pencil magnet held a brief distance from the underside of the patch, causing the patch to flex toward the magnet if the particles are magnetic.

Laser Fines (LF). Developed by Lockheed Martin for the military, LF is a promising amalgam of both particle counting and ferrography that greatly simplifies sample handling and analytical tedium, providing a computerized assessment of particle types and quantities.

Simplification, however, brings limitations and, thus far, LF has limited used as a full decision-making tool. Therefore, one should still consider using AF or Micropatch techniques (and perhaps vibration and thermography data) as a verifier in a decision to, for example, take a unit out of service and inspect it for wear, seal damage or other distress. Still, LF is one of the most sophisticated and promising screening methods available and will likely improve in scope with time and development.

Energy Dispersive X-ray Fluorescence (XRF). This is an increasingly attractive method for determining metallic and other elements in lubes, owing to greatly reduced cost and space requirements. Using X-ray bombardment of the sample to get specific, measurable (proportional, as per other spectral methods) radiation response from the elements of interest, the technique requires no pretreatment of the sample. Atomic number lower analytical limit (12) for XRF eliminates lithium, boron and sodium as analytical candidates, important elements in used lube analysis

Scanning Electron Microscopy (SEM). Highly focused electron beams striking a target (such as extracted metal particles from a lube sample) create an electron emission pattern that matches the particle and that is microscopically viewable after reconstruction into a black-and-white image. Among SEM's advantages are incredibly great detail and much greater magnification vs. conventional light-gathering microscopes.

SEM has been most often used as a research tool in the used lube analysis arena, primarily because it is too expensive to employ in any routine manner. Like XRF, however, its cost, size and operating environment constraints have greatly been reduced. SEM and XRF are nowadays combined to yield both composition and morphology of particles. While the cost is still significantly greater than other wear particle analysis methods, the cost of machinery downtime is continually rising, making this increasingly less expensive approach more appealing because it can be so incisive.

This concludes our cursory, limited survey into various methods and techniques for isolating, identifying and quantifying wear particles. While the modern lube analysis program hinges around machine condition, therefore focusing on component wear, supporting tests are vital in order for an evaluator to discern differences in similar patterns or trends in wear metals generation. Further additional tests will often disclose adverse conditions that, once remedied, will prevent or forestall wear, the most desirable scenario. <<

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