New Techniques in Grease Sampling and Analysis to Complement Condition Based Maintenance Programs

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Summary

Oil analysis is well established as a routine tool to optimize maintenance activities, improve reliability and equipment life and prevent component failures. As part of a comprehensive Condition Based Maintenance program, lubricant analysis is an effective complement to other diagnostic technologies such as vibration analysis, infrared thermography, ultrasonic detection and motor circuit evaluation. However, when the equipment is grease lubricated rather than oil lubricated, the important lubricant analysis piece is often left out of the mix. The reasons for this include challenges in obtaining samples that can be trended, as well as the large sample volumes required for most current standardized tests for greases. Unlike oil, grease does not typically flow uniformly or circulate in the machine, so particulate and contaminants are present in varying concentrations in the grease. When a grease sample is obtained, it cannot be simply agitated to suspend and distribute particulate, as is the case with oil. These fundamental differences present barriers to acceptance of grease analysis as a routine aspect of diagnostic monitoring programs.

New tools have been developed for improved sampling techniques and grease analysis tests have been added to address concerns of sample trending as well as accommodating small sample sizes. These include rheometry, or the flow characteristics of greases. Other new tests are emerging, including die extrusion, to efficiently prepare samples for analysis. Novel sampling aids have been introduced to permit consistent extraction of samples from locations that improve the representative nature of the sample, some of which have been incorporated into ASTM standards. Infrared thermographic monitoring of the flows of greases has provided insight into in-situ grease flow behavior, and has validated these sampling methods and improved understanding of good practices to obtain representative samples.

This paper details infrared studies of grease flow and the use of this information to ensure good sampling practice. Application of this understanding illustrates how new sampling and analysis technologies can produce improvements in reliability and reductions in lubrication costs through condition-based greasing and trending of wear levels, with samples as small as 1 gram. Advantages of preparing substrates with a thin-film grease deposition are discussed for purposes of more streamlined and uniform sample preparation for subsequent analysis. A colorimetric method for evaluating characteristics of new greases, and chemometric methods for evaluating contaminant levels for in-service greases are also discussed. Wind turbines, motors, motor operated valve gearboxes, and robotic assembly examples are given for these cost-benefits, and case studies are shared that demonstrate the return on investment in routine grease sampling and used grease analysis technology.