Engine Wear Measurement

New radiotracer tools are now available for the development of low emission engines and lubricants.

For the past seven years, DSi has been offering the automotive industry services and equipment for the measurement of engine wear (specifically the thin layer activation method). Thanks to the development of the latest radiotracer compounds, DSi opened new doors to innovative methods allowing a better accordance to the requirements coming from new environmental regulations.

Indeed, the latest environmental regulations have led major engine manufacturers to equip passenger vehicles with catalysts and diesel particle filters (DPFs). As a result, engine manufacturers and petroleum companies are developing new lubricant formulations to ensure the long-term performance of aftertreatment devices. Operation of DPFs and de-NOx systems can induce fuel dilution in the lubricant and accelerate the wear of critical engine parts such as camshafts and bearings.

The new radiotracer techniques can now help research engineers to gain a better understanding of the effect of fuel lubricant formulation on oil consumption, poisoning of aftertreatment devices and engine wear. Fuel dilution and lubricant aeration are damaging processes that can be studied quickly with radiotracer techniques, and a wide range of radiotracers are commercially available for testing internal combustion engines (ICEs) and lubricants. The chemical form can be selected in order to mark different functions of a lubricant without modifying its intrinsic properties.

DSi's online oil consumption measurement is a remarkable new development because it allows the shortening of engine test durations by a factor of 100 compared to conventional methods. Various molecules that are contained in the base oil are labeled with radiotracer organic compounds that are representative of its distillation interval. The impact of the base oil type and its additive content is evaluated in a very pertinent way.

The oil/fuel dilution in ICEs is another key application to modern diesel engines. Post-injection strategies and engine parameters can be optimized in order to reduce oil dilution levels or to further enhance fuel evaporation. A radiotracer compound is mixed with the lubricant, and the gamma ray signal issuing from the radiotracer is monitored continuously in a measuring chamber where the engine oil is circulated. As this signal decreases proportionally with the amount of fuel added to the engine oil, the dilution process is monitored during engine operation.

As another application of the radiotracers — and in the field of aftertreatment systems — DPF poisoning by ash from the combustion of oil additives (such as zinc from anti-wear additives and calcium from detergent additives) can be monitored during engine operation, thus revealing the actual effect of low ash lubricants on the lifetime of DPFs. Both 2D and 3D mapping of ash deposits inside DPFs is possible without opening or destroying the aftertreatment device.

To further highlight the progress made by the company, in October 2006, DSi received the SAE Award for Research on Automotive Lubricants for the SAE paper titled: An Innovative Online Measurement Method for Studying the Impact of Lubricant Formulations on Poisoning and Clogging of After-Treatment Devices.

By comparing these applications, it is clear that modern radiotracer techniques yield two major benefits: real-time results during engine operation and a very high sensitivity that also allows a reduction in test duration, regardless of the types of application.

All the services offered by DSi are available at the company’s new engine test center situated in Belgium. DSi engineers can also perform measurement at the client’s testing center, or manufacture and sell equipment adapted to specific needs.

Engineers from DSi begin the procedure of online oil consumption measurement for a recent auto powertrain project.

Measuring the signal emitted by the activated camshaft (which is also called the thin layer activation method).

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