Customer Profile | CHEVRON

Canadian Light Source / Centre canadien de rayonnement synchrotron

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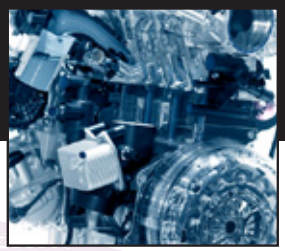

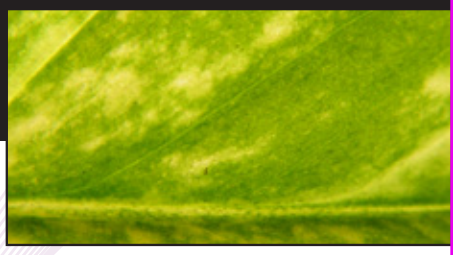

Greener Protection for Car Engines

For over half a century, one oil additive has been the overwhelming industry choice for preventing wear in car engines. But this chemical wunderkind, known as ZDDP, has a major drawback: it eventually causes the part of your exhaust system designed to reduce emissions to operate less efficiently.

For this reason, world energy giant Chevron is collaborating with the Canadian Light Source to study ZDDP – less mercifully called zinc dialkyl dithiophosphate. The researchers hope to reveal the complex workings of this popular additive, and create new anti-wear compounds that prove just as effective, and inexpensive.

While it is more cost-effective than the current alternatives, ZDDP's decomposition products shuffle downstream to the exhaust, and reduce the efficiency of the catalytic converter. With environmental laws becoming more stringent, car companies have turned to lubricant manufacturers to produce better alternatives.

The CLS, says Chevron researcher Elaine Yamaguchi, has broken new ground in this area of research. "It is well-known that the group at the Canadian Light Source is the premier group in the world for this kind of work," she adds. "And because of all the work that is going on there, research groups at other synchrotrons are beginning to use techniques like XANES."

Understanding ZDDP, and its ability to not only withstand but also cushion the engine's perpetual thundering of metal on metal, is more difficult than it may sound. The extremely thin lubricating film produced by ZDDP consists of phosphorous, sulphur, zinc and iron, which interact with other additives in a fully formulated oil.

The synchrotron has the unrivalled capacity to illuminate this molecular world. XANES (X-ray absorption near-edge structure spectroscopy) gives the researchers a rare edge: the ability to identify a metal, as well as its chemical form within the ZDDP film. This gives researchers the assurance that a compound found in the film, for instance, is indeed zinc polyphosphate and not iron polyphopsphate. Conventional techniques, such as X-ray photoelectron spectroscopy (XPS), lack the power to explore this chemistry.

The research has also taken advantage of the synchrotron version of XPS. Unlike the conventional version, synchrotron XPS "tunes" the wavelengths of the X-rays to explore the chemistry of these films, thus providing a unique understanding of the chemistry of the lubricating layer.

As the lead CLS Industrial Scientist working on the project, Jigang Zhou, explains, "It's funny. This is not like other research where you want to make a chemical better. The reason we're studying ZDDP is that we would like to get rid of it."

Elaine Yamaguchi, Staff Scientist, Chevron