The technology behind the Nanodrive range was developed entirely in house, in Millers' new state-of-the-art research and development centre

Nano Technology Lubricants from Millers Oils

Martyn Mann, Millers Oils technical director

Nevil Hall, Millers Oils joint managing director

A low friction oil developed for motorsport applications could provide a cost-effective reduction in the CO_2 emissions of road cars. Developed entirely in house by UK specialist oil developer and producer, Millers Oils, Nanodrive is a family of fully synthetic lubricants containing nanoparticles. Independent back-to-back tests on a Porsche 911 race engine showed an immediate power gain of over five percent by replacing a top conventional synthetic lubricant with Nanodrive oil of the same viscosity.

"In motorsport, lower friction means quicker lap times and reduced wear means fewer costly engine rebuilds," said Martyn Mann, Millers Oils technical director. "In the road car industry, there is mounting pressure to reduce vehicle fuel consumption and CO_2 emissions, so engineers are continually trying to improve engine efficiency through developments such as smaller bearings and low friction rings and cylinder liners. Nanodrive contributes to each of these requirements without needing any design modifications or changes to manufacturing. It can be implemented immediately and compared with engine modifications giving the same benefit, it is very low cost."

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Engine friction arises from two primary sources: viscous losses and boundary friction. "Viscous losses occur wherever a lubricant flows, due to shearing between adjacent layers of the oil," explained Mann. "To reduce the effect, engine manufacturers specify ever thinner grades of lubricant. Replacing a 5w30 multigrade oil with a 0w20 grade has been estimated to give a direct improvement of two percent in fuel consumption."

But, reducing viscous losses by using thinner oils risks increasing boundary friction and reducing engine life through increased wear, said Mann: "Boundary friction occurs where the oil films are so thin that opposing metal surfaces begin to interact with each other," he continued. "These conditions exist between piston rings and cylinder bores, and in the crankshaft bearings as they begin to rotate during engine start-up. As more vehicle manufacturers introduce stop-start technology to eliminate wasteful idling and improve urban fuel economy, start-up conditions will occur much more frequently, from an average of around 40,000 times in a lifetime to one million."

Millers Oils used nanotechnology to create a combination of low viscous friction and reduced boundary friction. Proven in their range of transmission lubricants that won the World Motorsport Symposium's Product Innovation award, the technology has now been further developed to provide a family of race engine lubricants.

Millers joint managing director, Nevil Hall, said that a Nanodrive variant for high performance road cars is already in development.

The precise chemistry involved is being kept confidential but Millers Oils attributes the breakthrough to the exceptional reactivity of the nanoparticles used in the formulation. "The particles we use have some very special properties that make them uniquely useful as lubricants for extreme conditions," said Mann. "As the contact load between opposing engine parts increases, reactions between the particles and the metallic surfaces actually lead to a reduction in friction. Another useful property is the way the nanoparticles nest around each other, like the layers of an onion, able to peel off under pressure, shedding a slippery, protective film over the metal surfaces to reduce friction and wear."

In comparison tests with conventional boundary lubricants such as molybdenum disulphide, conducted at Millers new R&D centre in Yorkshire (UK), Nanodrive lubricants reduced friction by up to 25 percent while increasing load capacity by up to 80 percent.

A typical test to compare the sliding friction performance of different lubricants involves a high frequency reciprocating rig in which a steel ball is loaded against a reciprocating plate. In a test for a Formula One transmission application the ball was loaded at 4 Gigapascals (approximately twice the service condition) while the temperature was increased from 40°C to 160°C at 3°C per minute.

Mann outlined the test results: "The friction coefficient of a standard road car oil was 0.17 and the average film strength (measured by electrical resistivity) 84 percent. A race oil from another manufacturer showed friction of 0.11 and film strength around 75 percent. A competition oil from another brand showed friction below 0.1 but highly variable film strength, averaging 34 percent. Another race oil showed a drop in friction above 140degC meaning any benefits are restricted to extreme temperature conditions.

Millers current triple ester synthetic oil showed a good friction figure with a film strength of 98% but the new Nanorange recorded a friction value that began to drop away from around 75°C, falling to 0.06 while retaining a film strength of 98% – halving the friction without losing any film strength.

The power gained by cutting frictional losses was independently demonstrated in rolling road tests on a Porsche 911 RSR. With a conventional 10w60 grade race lubricant, the car produced 268bhp, measured to DIN70020. On replacing the engine oil with Millers 10w60NT Nanodrive the result was 283bhp, an increase of 5.6 percent.

"With prices of Nanodrive oils only around a third higher than conventional synthetic lubricants, the power gains look extremely good value for money," concluded Hall. "Couple that with a corresponding CO_2 reduction and we believe that there is a key role for these lubricants beyond motorsport, particularly in vehicles with downsized bearings, in stop-start applications, where an immediate drop in CO_2 is required and in specialist high performance vehicles."

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www.millersoils.co.uk