D-Tribo™ Nanodiamond-based Nanoengineered Oil Additive

Detonation NDs are among the most promising nanoparticle lubricant additives being superhard, capable of dramatically reducing wear and drastically reducing the friction (up to 10 times) of sliding surfaces. Nanodiamond-based lubricant additives are aimed at increasing the fuel efficiency, performance, and durability of a wide range of industrial and transportation systems.
Detonation ND can provide the following global benefits: (i) reduced oil consumption through increased lubricant longevity, (ii) increased longevity of mechanisms experiencing friction, and (iii) reduced fuel consumption.

OEM approved bench fuel efficiency (FE) test on engines

From the testimony:

"An independent test laboratory (FL, USA) was commissioned to evaluate the ability of nanodiamond engine oil supplement to improve fuel economy in 4-cycle gasoline powered automobile engines.

The methodology involved establishment of a baseline fuel usage in three diverse engines using computerized and mechanical calculations. A proprietary testing protocol was used that included "city cycle" and high speed cruise. Each engine, prior to the baseline test, had a fresh oil change using SN quality 10W30 motor oil. The engines were a 6.5HP Briggs+Stratton 4-cycle, a Mercury Mariner SUV 3.0L, and a Toyota Corolla 1.6L. After the baseline fuel mileage was calculated the supplement was added. The engines were run for 8 to 12 hour period prior to fuel economy testing in order to fully activate the additive (this time period was decided upon after testing on a High Frequency Rotating Rig, HFRR).

1) The Briggs+Stratton engine produced a clear 0.5 to 1.5% fuel economy improvement.

2) The Mercury engine test was conducted by a Lincoln/Mercury dealership under supervision of the independent test laboratory. A driving test cycle was designed using the Ford computerized fuel economy test system. The computer was installed in a 2008 Mercury SUV 3.0 L engine used in many vehicles. Then the vehicle was engaged in the test cycle consisting of a prescribed stop and go, acceleration, steady RPM running, and so on. The vehicle had an initial oil change using the Mobil 5W-30 SN. Then the vehicle was tested to form the baseline gas mileage, that was 23.7 mpg. The supplement "D-Tribo" was added (5%) and the vehicle was run for two weeks plus. It was a shuttle vehicle driven more then 700 miles filling the tank twice. The exact test cycle procedure was performed again. The vehicle averaged 24.5 mpg. The test was extended and the mpg continued to range 24.3 to 24.7 mpg. This demonstrates an improvement of about 3.5%. The test was repeated as the improvement exceeded expectations. Again, results ranged from a 3.1 to 3.9% gain. Very significant in my opinion especially in view of past experience in such testing. As a comparison we recorded a 1 to 2% increase in fuel economy using the Mobil 1 Fuel Economy oil formulation. Other fuel economy improving additives tested by us previously resulted in either no improvement or less then 1%. Extrapolating, one would estimate that the average motorist would save about $150 per year in gas.

3) The third tests involved the Toyota Corolla. This time 2.5% of D-Tribo was added. Additionally, we decided to do a "long term" test (6 weeks) and to use new technology to verify fuel mileage. For the first two weeks of testing mileage stood at 28.3 to 28.7mpg. Then suddenly mileage increased to a range of 29.7 to 30.1mpg. About 4.5% improvement. And it remained there.

The independent laboratory stands behind this findings w/the proviso that though probably any engine would see an increase in fuel economy, the amount would vary w/respect to engine design and type of driving."

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Summary/assessement from engine tests: "Through multiple tests on various engines using state of the art technology and a comprehensive test protocol, the results are clear. There is a definitive and significant fuel economy improvement when using D-Tribo supplement. That improvement will vary due to different engine designs and driving styles. The mechanism by which the D-Tribo works appear to be a reduction of internal engine friction during boundary lubrication conditions. As such, even additional fuel economy benefits may be expected from the newly designed engines which are smaller and produce more output. Turbo charged engines, as well, may see even greater results."

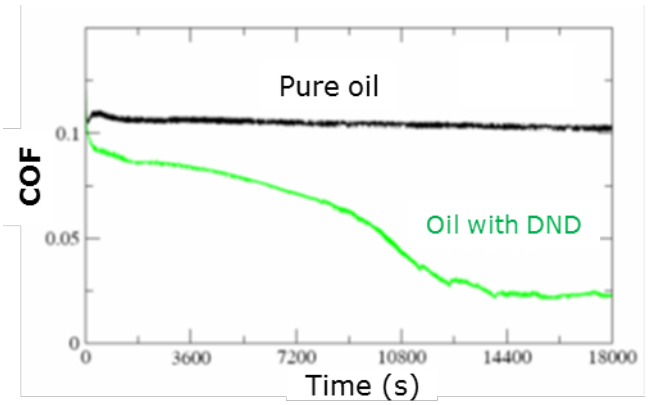
Personal tests on passenger's cars

Real life tests on the influence of the DND additives mixed with motor oil on gasoline consumption were also performed. In the tests, a Toyota Celica 2003 and Ford Focus, 2002 were used. Before the oil was changed, the cars had average gasoline consumption of 29.5 miles per gallon (mpg) and 31.4mpg, correspondingly. After oil change (5W30 Exxon Mobile Superflow oil for Toyota and 10W30 Pennsoil for Ford), 200ml of D-Tribo additive was added to 4 quarts of the motor oil for each car. Following consequent gas fillings gas mileage was calculated to be for Toyota; 30.6; 30.0; 32.8; 31.2; 31.2 mpg and for Ford: 30.7; 33.2; 33.5mpg. On average, improvement in fuel consumption efficiency was 5.6% (31.2mpg) for Toyota and 3.4% (32.5mpg) for Ford. In both tests, after the first 1-2 gas fillings, the observed improvement was modest (Toyota) or no improvement was observed (Ford). However, after that gasoline consumption improvement stabilized at a level of approximately 5-7%. In both cars, the engines started to work more quietly after introducing the additive.

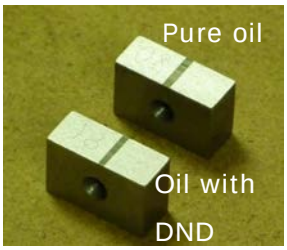
Laboratory tests

During development of nanodiamond-based nanolubricants, several hundreds laboratory tests had been run at International Technology Center (ITC), Raleigh, NC and Ural Federal University (UFU), Yekaterinburg, Russian Federation. ITC used Bruker's UMT-3 high-load tribometer designed for comprehensive macro- mechanical tests of lubricants. UFU's tests were performed using a 4-ball testing apparatus ЧМТ-1 (4-ball tests and a custom build ring-on-disk module), and shaft-bushing technique.

Coefficient of friction (COF) of D-Tribo measured as a function of time using a block on ring test at UMT-3 tribometer for pure Mobil Super 5W30 oil and Mobil containing NDs is shown below. Load was 30kg, rotation speed 200rpm, hardness of block and ring H30 and H60, correspondingly. The wear scar of the sample treated with the DND additive was twice less than that for pure oil (photo below).



Coefficient of friction (COF) measured as a function of time in block on ring test UMT-3 apparatus for pure Mobil Super 5W30 SN oil and Mobil containing D-Tribo Additive (DND). H30 block over H60 ring test at 200rpm\30kg 5hrs.



The wear scars of the samples tested with pure oil and the oil with D-Tribo.

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