



NANO MATERIALS & PROCESSES INC.

## ENGINE OIL ADDITIVE - FM™

### Product Description and Benefits

Engine Oil Additive – FM™ is available in two blends: **FM-Conditioner** and **FM-Protect**.

FM-Conditioner is a blend of specially prepared 4-10 nm (initial crystal size) nanodiamonds in a graphene shell and other materials in semisynthetic oil. It conditions the surface of worn cylinder walls, bearing journals, camshafts and other oil lubricated components over a 1,500-2,000 mile break-in prior to the long term use of FM-Protect. FM-Conditioner may be used a maximum of two times on badly worn engines.

FM-Protect is a blend of 4-10 nm (initial crystal size) nanodiamonds with a graphene shell in a synthetic oil base that is added with each engine oil and filter change for the life of the vehicle.

Engine Oil Additive FM delivers a range of benefits that significantly lowers the total cost of ownership of the engine and vehicle operating cost. These benefits derive from the size and physical and chemical characteristics of the nanodiamonds:

- Friction Reduction

Even surfaces that appear to be smooth and have been finished to a very fine tolerance have microscopic imperfections. When two metal surfaces pass by each other in close contact, these imperfections ‘catch’ and produce erosion by electrosparking, creating wear and heat. Nanodiamonds fill-in micro-cracks in surfaces that are subject to ‘metal-to-metal’ contact. Nanodiamonds also penetrate the crystal lattice of the metal to harden the surface layers of a friction pair and increase their fatigue resistance. Further, nanodiamonds adsorb oil on their surface to form a ‘greasing cover’ that retains a layer of oil even in absence of lubrication conditions.

Nanodiamonds increase the lubricity of engine oil. Untreated engine oil thins out under high heat and hydrodynamic wedge conditions causing wear from metal-metal micro-contacting. The exceptionally high surface activity of nanodiamonds causes the engine oil to maintain its viscosity and lubricity even under these conditions.

Nanodiamonds reduce the coefficient of friction by 12.9% in Falex testing. The wear scar is reduced by 15.6% following initial break-in.

Friction reduction frequently improves fuel economy. In SAE J-1321 testing, Engine Oil Additive FM-Protect showed a 1.06 – 1.19% improvement. Actual results will vary based upon application.

- Increased Load Bearing Capability

Surfaces conditioned by nanodiamonds are harder and able to withstand loads that are 17.3% higher in Falex testing.

Tested PIN and V Block Material	PSI Load	Wear Scar	Coefficient of Friction
Oil Only, No Break-in	81,605	0.225	0.116
DSND, No Break-in	72,537	0.250	0.113
DSND, 6-Hour Break-in	72,537	0.250	0.101
DSND, 30 Hour Break-in	72,537	0.250	0.110
DSND, 48-Hour Break-in	95,709	0.190	0.101
<b>Improvement After 48-Hour Break-in</b>	<b>17.3%</b>	<b>15.6%</b>	<b>12.9%</b>

Table 1 – Test Method: ASTM D3233B Modified (Falex)

- Reduced Production of Pollution Products

Engine Oil Additive-FM components migrate into the combustion chamber through vaporization of engine oil and recycling through the Exhaust Gas Recirculation (EGR) system. Since the flash point of nanodiamond is higher than that of the fuel they do not ignite, but are dispersed in the air/fuel mixture where they *act as a catalyst to improve the combustion process*. As a result, the production of soot is drastically reduced with reductions in emissions of NO<sub>x</sub>, CO and hydrocarbons. In diesel engines this significantly impacts the load on the soot capture system and the consumption of fuel to eliminate collected soot. It also reduces the cost of DEF to reduce NOX. For some types of vehicles it may also increase the number of hours per day the vehicle can be utilized saving both operator time and, for large operations, reducing the quantity of vehicles and operators needed. (For greatest effect in diesel engines, use Diesel Fuel Additive – CC™.)

- Temperature Stability

Oil is a natural insulator and heat is an enemy of lubricant and component life. Nanodiamond is a natural conductor and facilitates the movement of heat out of the engine. This can be seen in stabilized operating temperature and the improved time to cool down for the engine.

- Extended Engine Component Life

As a result of the surface finishing and high surface activity of the nanodiamond that improves the lubricity of the oil and reduces oil contaminants, the life of the

lubricated components is extended by 2X to 4X, even under severe conditions of use.

- Extended Engine Oil Life

The breakdown of the engine oil additive package is closely related to the production of soot by combustion and the collection of impurities produced by electrospark erosion. By significantly reducing the production of engine oil contaminants the engine oil and additive package life are extended by approximately 2-1/2 X. The useful life of engine oil will vary by application and environment. Actual life is determined by using periodic laboratory testing and measurement of the Total Base Number (“TBN”).

Direct benefits from extended engine oil life include (a) reduced vehicle downtime; for a 100,000 annual mileage vehicle using a 25,000 mile oil change cycle it saves two annual oil changes and the costs related to those changes, (b) (potentially) reduced size of maintenance facilities and number of related personnel and (c) reduction in the total quantity of vehicles needed in very large fleets because of increased availability.

**NOTE: BENEFITS DEVELOP GRADUALLY AND IMPROVE OVER TIME. THEY CAN BE MEASURED OR OBSERVED.**

## Applications

Engine Oil Additive – FM can be added to any engine with a lubricating oil sump. This includes both vehicular and non-vehicular engines (e.g., generators). Typical applications include:

- Trucks
- Buses
- Locomotives
- Generators
- Taxis
- Off Highway Equipment such as skid loaders, excavating equipment,
- mining equipment and construction equipment
- Passenger cars
- High performance vehicles (USE ONLY FM-PROTECT)

## Determining the Quantity of Engine Oil Additive – FM Required

Use the quantity of Engine Oil Additive – FM as indicated in the following table. If your engine oil capacity (including filter) does not fall into one of the ranges below, you can calculate the amount needed using the ratio 1:100 for additive:oil capacity.

Recommended Additive Package Size	
Oil Sump Capacity in Quarts	Additive-FM Package Size
4-6	1.6 oz.
6-8	2.5 oz.
36-42	12 oz.
42-50	15 oz.

**DO NOT USE MORE THAN THE RECOMMENDED AMOUNT; RESULTS WILL BE IMPAIRED!**

Contact Nano Materials and Processes, Inc. for no-charge application engineering support.

**WHEN USED AS DIRECTED, YOUR SATISFACTION IS UNCONDITIONALLY GUARANTEED OR YOUR MONEY BACK. [ASK ABOUT OUR NO-RISK TRIAL OFFER FOR VEHICLE FLEETS.](#)**

### **Additional Information**

Independent laboratory test report using ASTM D3233B Modified Falex Pin & V Block Test is available. Testing was conducted by Petro-Lubricant Testing Laboratories, Inc.

Independent laboratory report using SAE J-1321 by Texas Transportation Institute.

The report of a race team crew chief is available.

Please see our website at [www.nanompi.com](http://www.nanompi.com) or call us at 248-529-3873.