Technology Summary: Engine Oil Additive

Opportunity Statement

Engine oil additives are used to improve the base oil into a better performing lubricant. A lubricant additive package can comprise anywhere from 1% of a finished hydraulic oil to approximately 20% of a typical multi-grade motor oil. There are various types of additives including: detergent additives; friction modifiers; viscosity modifiers; deposit control additives; corrosion-, oxidation- or rust-inhibiting additives; antioxidant additives; anti-wear additives; anti-foam agents; seal conditioners; metal deactivators; extreme pressure agents; dispersants and wax crystal modifiers.

Problem

With the increase in the number of vehicles, the problems with fuel consumption and environmental pollution are becoming more prominent. The use of an energy-conserving and emission-reducing automotive engine oil additive would have a great impact on energy conservation and environment protection. However, such an additive would need to enhance, or at least maintain, the most important desirable lubrication properties, such as viscosity index, low-temperature performance, high-temperature performance and oxidation resistance.

Therefore, there is a need for an engine oil additive that decreases fuel consumption and environmental pollutants while maintaining or enhancing key lubrication properties.

360ip Partner's Solution

The product involves an engine oil additive composed of nanometric tungsten disulphide (WS_2) powder, nanometric molybdenum disulphide (MoS_2) powder, dispersant, antioxidant and metal deactivator. The most impactful and distinctive feature of the product is the use of **WS_2 nanoparticles**, considered one of the best lubricating materials in the industry.

The nanoparticles, averaging 100nm-200nm in size, are created by a proprietary process that allows them to be evenly dispersed in the base oil. Actual usage shows that the nanoparticles do not agglomerate and will not block the oil filter. The nanoparticles form a protective layer on metal surfaces which reduces abrasion to friction-prone surfaces. (See **Annex A**)

Tests also indicate that engine oil containing the WS_2 nanoparticles outperforms existing products in the market. (See **Annex B**)

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The additive has undergone independent, third-party testing. The tests were conducted in accordance with QC/T 524-2005, Testing Methods for Automobile Engine Characteristics. The nanoparticle additive was added to 10W-40 engine oil and its performance was compared against 10W-40 engine oil without the additive.

The following are the results for a gasoline engine:

- Reduced fuel consumption by 5%-9.5%, increased engine power by 3.4%-6.8% and increased torque by 3.4%-6.9%.
- Reduced hydrocarbon emissions by 41.7% at low speed.

No.	RPM	Engine Oil	Torque/N.m	Power/kW	Fuel Consumption g.kwh	Fuel Consumption Reduction	Torque Increase	Power Increase
1	4500	10W-40	133.92	63.11	302.17	5.3%	3.5%	3.4%
		10W-40 + Additive	138.57	65.27	286.06			
2	4000	10W-40	129.57	54.27	314.89	9.0%	6.5%	6.5%
		10W-40 + Additive	137.93	57.8	286.55			
3	3500	10W-40	139.77	51.23	257.15	7.1%	3.8%	4.7%
		10W-40 + Additive	145.1	53.63	238.85			
4	3300	10W-40	139.8	48.31	247.15	5.2%	4.1%	4.0%
		10W-40 + Additive	145.56	50.26	234.25			
5	3000	10W-40	140.38	44.1	242.96	5.9%	4.4%	4.4%
		10W-40 + Additive	146.57	46.02	228.73			
6	2700	10W-40	143.08	40.47	236.71	5.1%	3.4%	3.5%
		10W-40 + Additive	147.97	41.89	224.73			
7	2500	10W-40	143.64	37.61	235.02	5.1%	3.5%	3.5%
		10W-40 + Additive	148.65	38.93	222.92			
8	2300	10W-40	140.37	33.8	235.64	5.4%	3.5%	3.8%
		10W-40 + Additive	145.3	35.1	222.85			
9	2000	10W-40	134.51	28.17	239.08	5.3%	3.6%	3.7%
		10W-40 + Additive	139.3	29.22	226.36			
10	1800	10W-40	134.55	25.37	237.11	5.0%	3.5%	3.4%
		10W-40 + Additive	139.26	26.24	225.23			
11	1500	10W-40	128.5	22.17	247.62	9.5%	6.8%	6.9%
		10W-40 + Additive	137.3	23.7	224.1			

Similar results were also reported for diesel engines.

Additives for different applications (e.g., marine, compressor, industrial applications, etc.) that can provide similar improvements in lubricant performance can also be formulated based on our Partner's proprietary technologies.

Patents

360ip's Partner has filed two patent applications on this invention.

360ip is seeking interested parties for the development/marketing/sales of the engine oil additive and WS_2 nanoparticles.

For additional information, contact:
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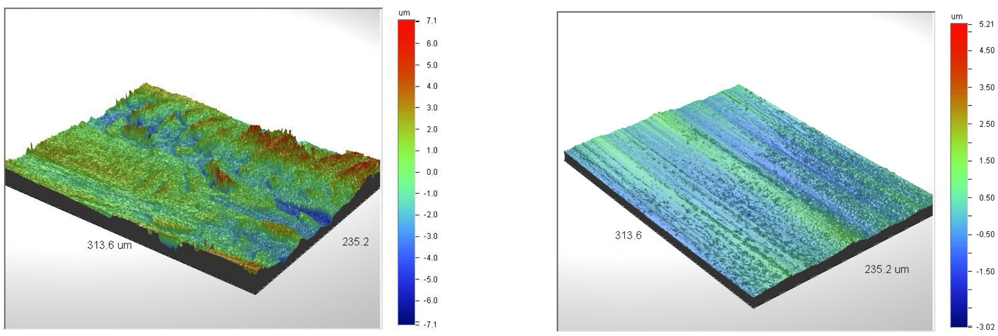
Annex A

Properties of Engine Oil Additive

1. Reduces abrasion and wear

The nanoparticles in the additive form a self-renewing protection layer on the piston ring and reduce frictional wear on the contact surfaces as shown in Figure 1 below.



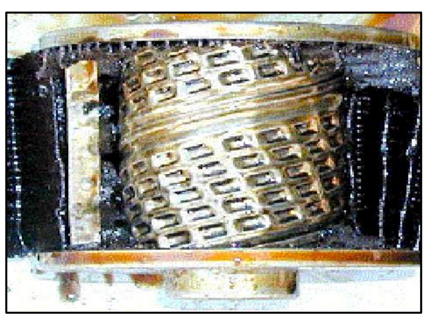
a. Conventional engine oil (Image shows a rough surface caused by abrasion during engine operation.)

b. Conventional engine oil + additive (Image shows a smooth surface indicating lesser wear and abrasion of the surface)

Figure 1 3D Image of Engine Piston Rings (after 10000km)

2. Excellent detergent-dispersal properties

Ultrafine nanoparticles (100nm to 200nm) will not clog up the filters as shown in Figure 2.



Engine oil filter removed from vehicle after traveling for 9800km using conventional engine oil with additive. The filter appears clean and unclogged, suggesting the additive provides good detergent-dispersal properties.

Figure 2 Engine Oil Filter

Annex B

Efficacy of WS_2 nanoparticles

An engine simulator was designed in-house to compare the performance of WS_2-loaded engine oil with similar products from major lubricant manufacturers. The engine simulator was operated at idle speed under different loading conditions with the fuel consumption monitored continuously. The weight of the oil control ring and pressure control ring was also measured before and after engine operation to compare the frictional loss associated with the use of different types of engine oil.

Results show that the use of WS_2 nanoparticles can provide significant savings in fuel consumption compared to other engine oil formulations in the market. (See Figure 3)

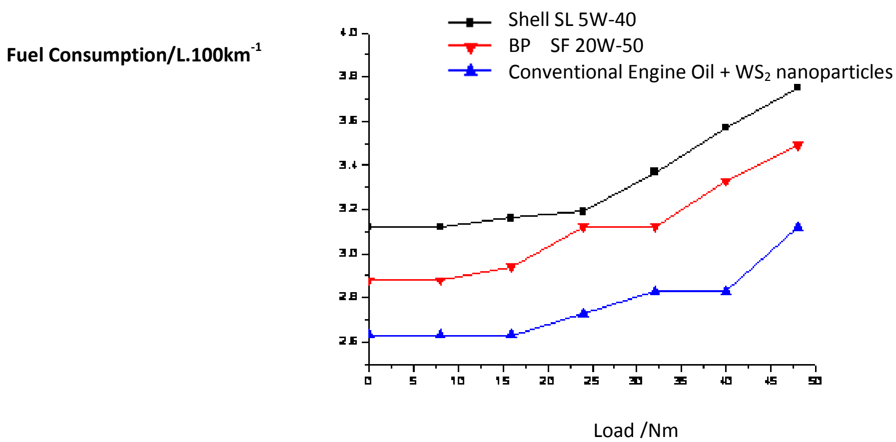


Figure 3 Comparison of Fuel Consumption for Different Types of Engine Oil

Data from the experiments (See Table 1) also indicates that the use of WS_2 nanoparticles can result in reduced frictional loss relative to similar offerings in the market.

	Friction Loss for Pressure Control Ring/mg	Friction Loss for Oil Control Ring/mg	Total Friction Loss/mg
Shell SL 5W-40	5.68	1.91	7.59
BP SF 20W-50	5.56	1.89	7.45
Conventional Engine Oil + WS2 nanoparticles	2.32	0.79	3.11

Table 1 Comparison of Frictional Loss for different types of Engine Oil