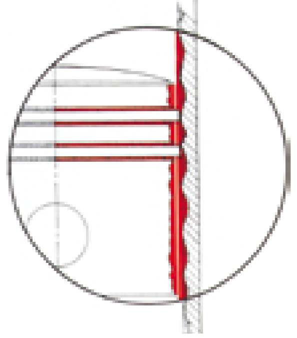
LUBRICATION AND COATING



Lubricating oil is a liquid blend made from a base that can be of mineral, semi-synthetic or synthetic origin and a set of additives such as dispersants, antioxidants, detergents, rust inhibitors, corrosion inhibitors, antifoams, anti-wear, viscosity correctors and so on.
These elements are added to the second applications to which the lubricant is intended.
The main purpose of oil is to lubricate moving parts.

However, there are moments in which mechanical components are in "precarious lubrication" conditions:
- at start-ups friction and wear are very high resulting in massive wear and tear, (and low temperatures accentuate this problem).
- at high temperatures, the oil fluidizes by losing lubricant power.
- the abrupt load variations which may be a violent acceleration, the lubricating dynamic film cuts.

At these moments the metal-metal contact occurs which causes friction and consequent heavy wear.

To meet the limits of liquid lubricants, both in temperatures and pressure resistances, and to go beyond performance, it is used to "coat", that is to the surface coating of metals.

The "coating" helps with normal lubrication. This treatment makes the self-lubricating surfaces even in boundary lubrication situations thus allowing the non-contact between mating surfaces.
As a result, even in times of lack or lack of dynamic lubrication, the metals are protected and do not wear.
To do this, so-called solid lubricants are used (see table: "PROPERTIES OF SOLID LUBRICANTS").

By comparing the physical chemical characteristics of the solid lubricants, the excellent material for these applications is PTFE (polytetrafluoroethylene).
PTFE-based anti-friction coatings, as well as lowering the friction coefficient between mechanical couplings, has a double temperature resistance related to oils.

Thanks to the sealant effect of PTFE film, is improved the seal between the couplings. In the case of an engine, this will result in an increase in compression and consequently improvement of combustion and efficiency of the engine itself.
This also results in a decrease in oil consumption and pollutant emissions.

With less friction, it will have a lower power consumption, a drop in the lubricant liquid temperature, and a reduction in noise. Engine life lasts longer.

PROPERTIES OF SOLID LUBRICANTS

	GRAPHITE	MOS2*	PTFE	BN**
COLOURS	BLACK	BLACK	WHITE	WHITE
DENSITY	2.25	4.8	2.2	2.2
COEFFICIENT OF FRICTION				
- STATIC	0.2	0.3	0.05	0.2
- DYNAMIC	0.05	0.05	0.02	0.05
HEAT RESISTANCE	600°C	400°C	310°C	1200°C
CHEMICAL RESISTANCE	EXCELLENT	POOR	EXCELLENT	EXCELLENT
DECOMPOSITION PRODUCTS	GASES	SOLIDS	GASES	SOLIDS
PARTICLE FORM	LAMELLAR	IRREGULAR	SPHEROID	IRREGULAR

*** MOS2 = Molybden disulphur**
**** BN = Boron nitride** *(improperly called ceramic)*

By looking at the solid lubricant table that can be used in anti-friction treatments, our choice has been touched on polytetrafluoroethylene (PTFE), the outstanding material for these applications due to its features such as the lowest absolute friction coefficient, infinitesimal particle size, spheroidal shape that does not clogs filter or dirty ducts, and the absence of decomposition by-products.

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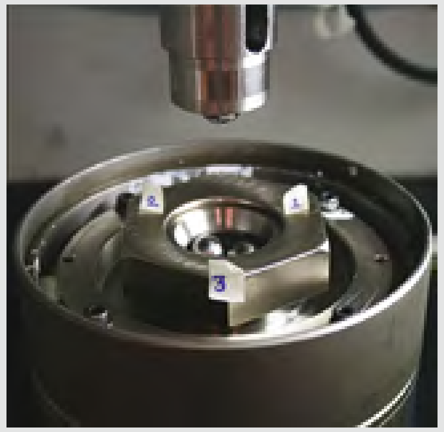
At the Corrosion and Metallurgy Research Center of the Department of Engineering of the University of Ferrara, which deals with problems concerning the study of tribological behavior (friction and wear) of coatings on metals, alloys, etc. a test was conducted to evaluate the reduction of the friction coefficient and mechanical wear behavior phenomena resulting from the combination with synthetic lubricant oil for high performance vehicles, a "Protector" anti-wear Sintoflon treatment.

The effect of the treatment was evaluated using the Ducom Multi Specimen Tester Tribometer in "Four-Ball Method" configuration according to the standards required by the international regulations ASTM D 4172-94 (2010) "Evaluation of the friction coefficient and calculation of the wear rate".

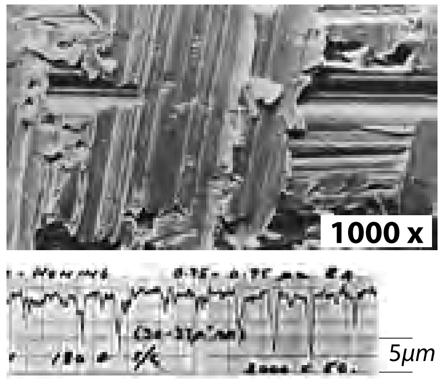
Test conclusions are highlighted in the chart below.



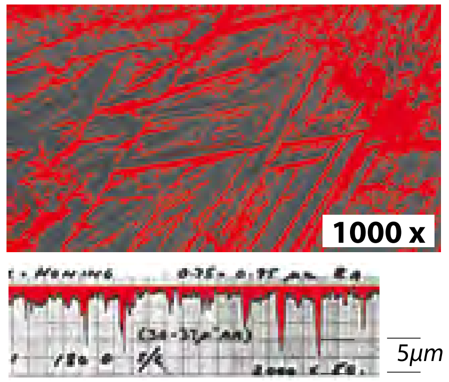
Techim Sintoflon boasts a know-how ultra-thirty years in the field of anti-wear nanotechnology coatings.

Sintoflon coating treatments redefine new friction reduction limits.

A picture of one of the many tests conducted on engines without hydrodynamic lubrication (without oil) and previously treated with Sintoflon. Observe the connecting rods.



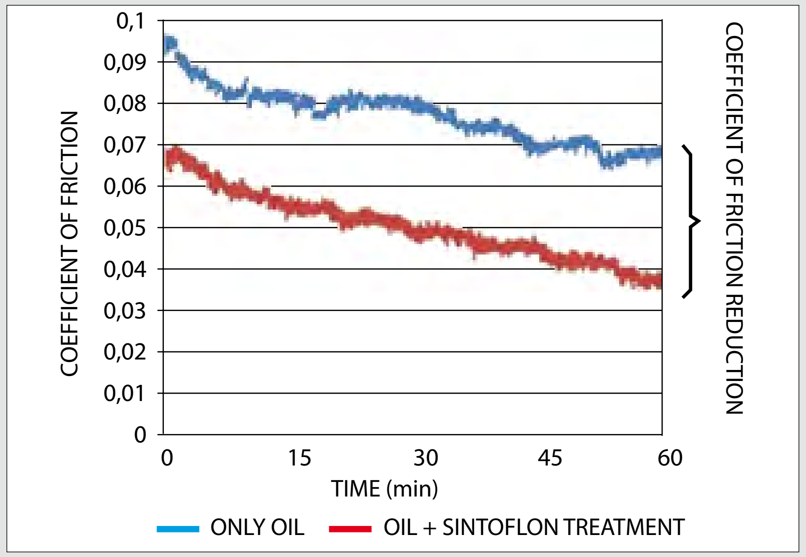
Typical aspect of cylinder pattern seen by microscope (1000x) The graph shows the "peaks and valleys. "



Sintoflon treatment coating fills the "valleys" leveling the surfaces as shown in red in the chart.

SEM electronic scanning microscope, equipped with EDS microsound for X-ray microanalysis, provided with the "Aldo Daccò" Study Center of Ferrara University.

To the left:
Tribo DUCOM Multispecimen Tester.
As required by law, to evaluate
The anti-wear properties of lubricating oils
Is evaluated with the "Four-Ball Wear Test" configuration.



The addition of Protector, in the optimum 10%, significantly reduces the friction coefficient of the coupling, increasing the oil anti-wear properties.

Test	Coefficient of friction	Wear rate mm /(N.m)
only oil	0,07	7,18.10-5
Oil + 10% Sintoflon Protector	0,04	6,63.10-5

Note how with the Sintoflon treatment, the friction coefficient reduction is almost 50%