Technischer Beratungsdienst an der Fachhochschule Ulm
(Mitglied der Steinbeis-Stiftung für Wirtschaftsförderung Stuttgart)

Demonstrating the effectiveness of HIT-FLON®

Contents

1. Introduction

The oil additive HIT-FLON® is a polytetraflourethylene additive (PTFE). By adding a certain amount to the engine oil, producing a tough long lasting viscosity coat on the metal surfaces in contact with the engine oil during engine operation thus reducing engine wear immediately. The object of the analysis described in to following is to demonstrate the coating and its reduction of wear.

2. Demonstration of coating by means of the scanning electron microscope.

The effectiveness of HIT-FLON® is reputed to lie in a coating of PTFE on metal surfaces exposed to the engine lubrication system. By means of scanning under the electron microscope it is possible to bombard the metal sample of interest with electrons. The reflected electrons produce an image of the metal surfaces on an luminescent screen or on sensitive film material. In such an organic coating as PTFE, for example, the metal surface is rendered non-conducting, thus reducing reflection of the electrons, i.e. crisp features become blurred. This blurr demonstrates the presence of a film of material containing an organic substance.

2.1 Test conditions

For evaluation of the coated metal surface use was made of the cylinder liner of a full engine, it being compared after the engine was run on a test bed with and without the oil additive HIT-FLON®.

Operating data:

Engine:	Renault 800 S 5	Air intake temperature:	40°C
Capacity:	850 cm³	Oil temperature:	80...90°C
Speed:	3000 1/min	Water temperature:	80°C
Output:	15 kW		
Cooling:	water		

Engine oil: branded oil HD 15W40

Engine running time without oil additive: 8 hours
Engine running time with oil additive: 8 hours

The cylinder liners were removed after the running period and a sample of approx. 1 cm² cut out from the surface.

The samples were taken from the liners in the vicinity of the top dead centre for the upper piston ring and examined under the scanning electron microscope.

2.2 Results

Fig. 1 shows the texture of the cylinder liner surface of the sample without HIT FLON® magnified 500 times.
Fig. 2 shows a section of Fig. 1 magnified 2000 times.
Fig. 3 and 4 show the corresponding cylinder surface textures of the sample with HIT-FLON® magnified 500 and 2000 times.
The coated sample is characterized by diffuse scoring and blunt edges thus demonstrating the presence of a coating by an organic substance.

3. Demonstrating the PTFE coating by means of microanalytical determination of fluorine.

Demonstrating that the organic substance is a PTFE coating is only possible by demonstrating the presence of fluorine which polytetrafluorethylene contains as its characteristic element. The electronic beam of the scanning electron microscope causes the element in the cylinder liner surface to emit a characteristic radiographic radiation.
The diagram shows part of the complete spectrum in the wavelength sector of the element fluorine.
Diagram 1 shows this spectrum without HIT-FLON® whilst diagram 2 shows it with HIT-FLON®. The fluorine line at 2.86 Å can clearly be seen in diagram 2, it being missing altogether in diagram 1. This evidences the presence of fluorine.

4. Demonstrating the reduction of wear by means of radio isotopes.

Introducing HIT-FLON® to produce a PTFE coating on the friction surfaces of an engine is anticipated to achieve a reduction in wear.
For this test, radio isotopes were used by depositing a 10 micron film of radio active iron by galvanic means on the friction surface of a piston ring. The radioactive piston ring was then put in a full engine. After 5 hours of running on an engine test bed the oil additive HIT-FLON® was added while the engine was running.
The engine was then run for 9 hrs under the same operating conditions and the radioactive radiation outside the engine assay measured.

The change in the radiation intensity/wear rate with time was recorded as a function of the engine running time continuously.
Comparing the rates of wear with and without the additive produced a definite demonstration of the effectiveness of the additive. The engine operating date was the same as given in Section 2.1. The results are shown in diagrams 3 and 4. The reduction in wear was demonstrated two hours after adding HIT-FLON® up to the end of testing.
The reduction in wear of the piston ring friction surface was 54%.

5. Summary

The effectiveness of HIT-FLON® is based on a coating of polytetrafluorethylene on metal surfaces coming in contact with the engine-lubrication system. This coating was demonstrated by scanning electron microscopic analysis. The microanalytical evaluation demonstrated the fluorine content of the coating. One result of the coating was established to be a reduction in wear due to the oil additive. In full engine test a 54% reduction of wear of a piston ring surface was demonstrated by radio isotope analysis.

Ulm, this day 15.6.82

Signature Schade

Technical Counselling Service
of the Technical University of Ulm.

The scanning electron microscopic and microanalytical evaluations were carried out at the Institute of Scanning Electron Microscopy, Munich.
All aspects of testing and the wear evaluations on the full engine were the responsibility of the Technical Counselling Services of the Technical University.

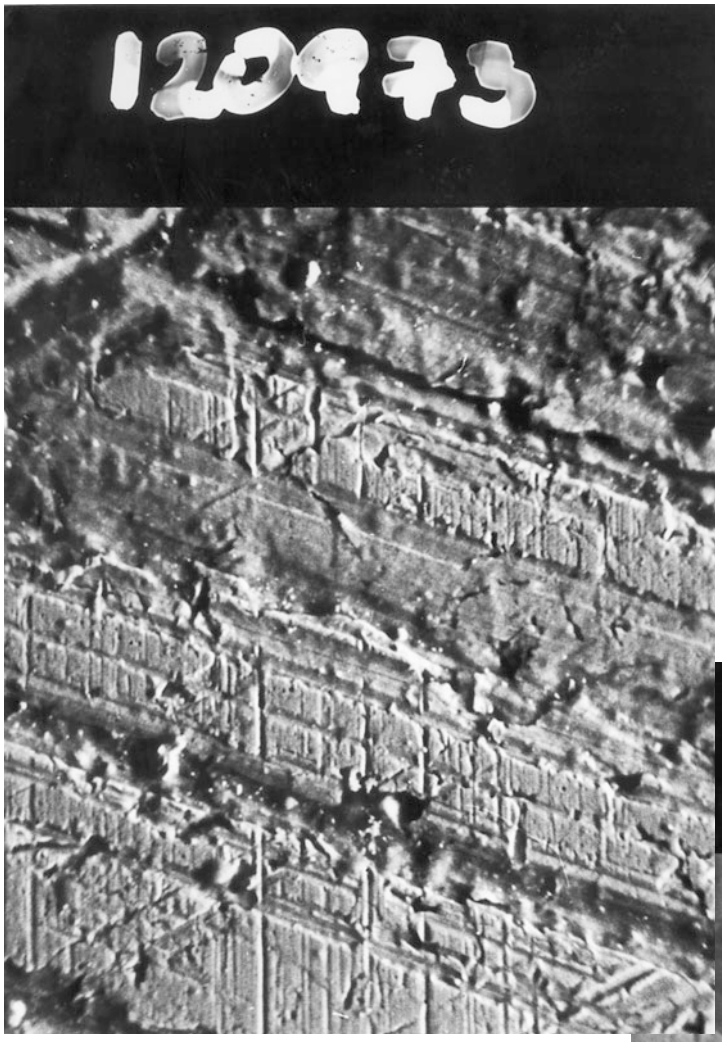

Fig. 1
Cylinder liner texture without oil additive after 8 hours engine running,
500 times magnification
(photo: institute for scanning Electron Microscopy Munich)

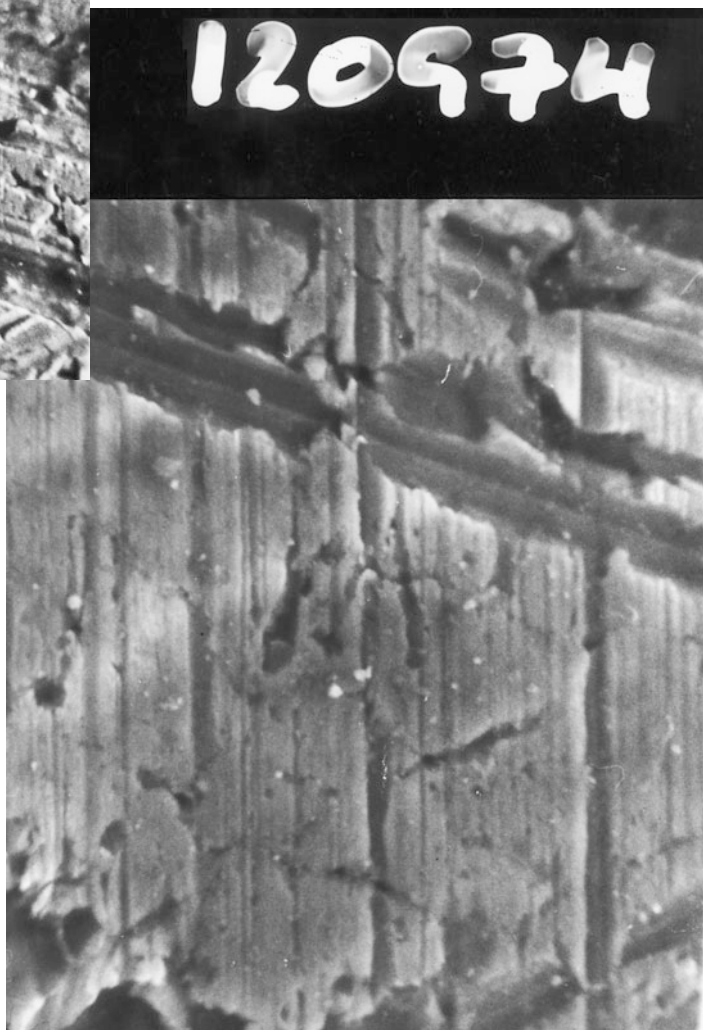

Fig. 2
Magnified section of Fig. 1
2000 times magnification

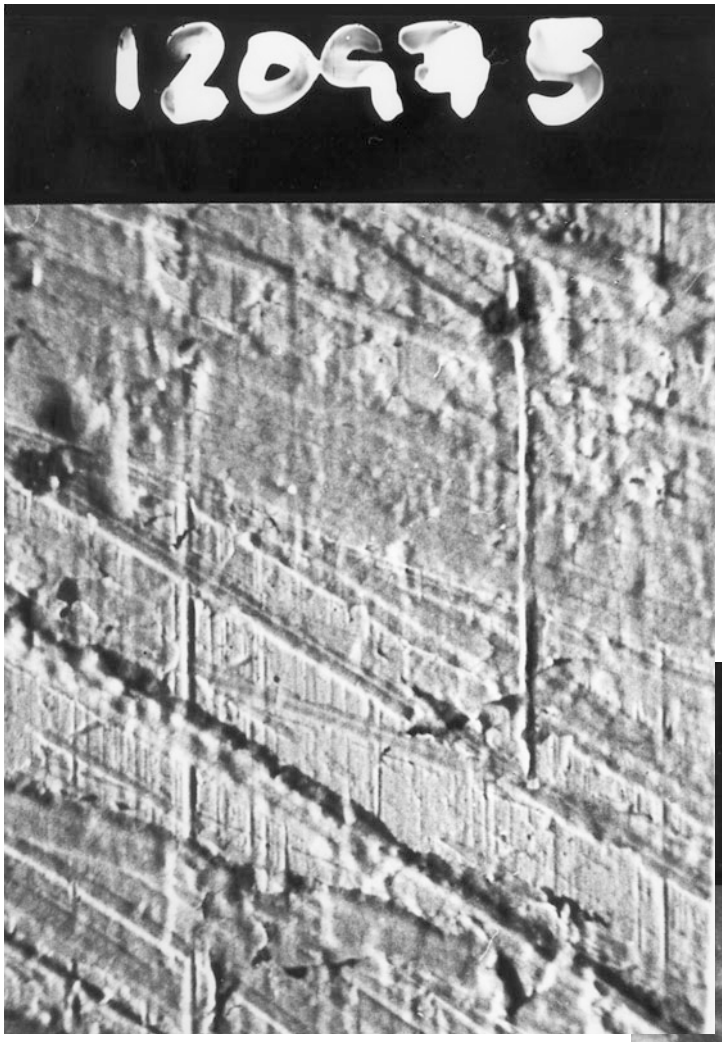

Fig. 3
Cylinder liner texture with HIT-FLON® after 8 hours engine running,
500 times magnification
(photo: institute for scanning Electron Microscopy Munich)

Fig. 4
Magnified section of Fig. 3
2000 times magnification

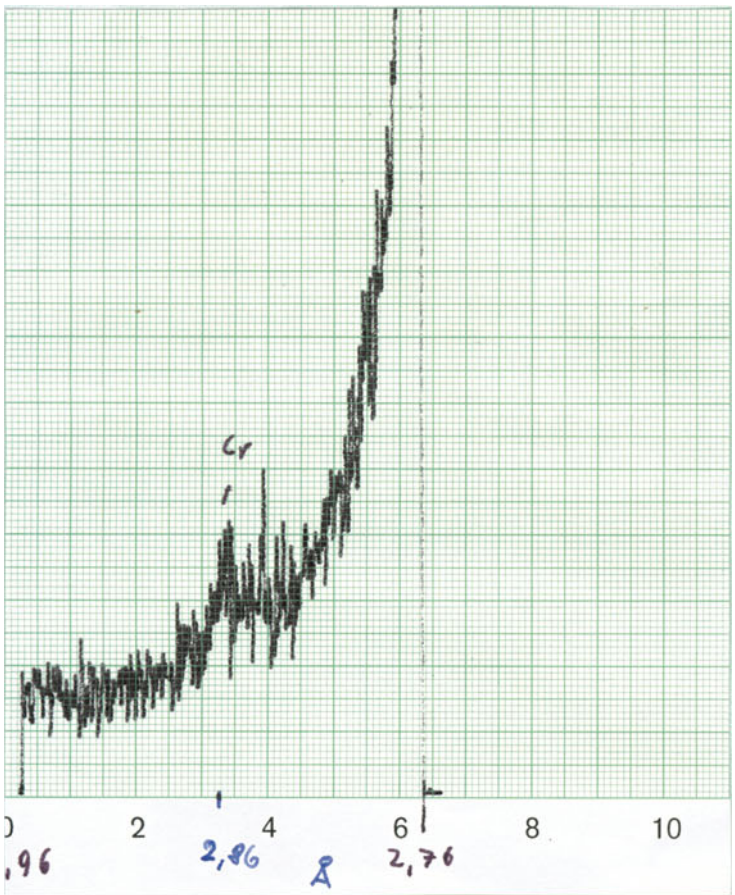

Diagram 1
Microanalytical evaluation of cylinder liner surface material without oil additive, no fluorine demonstrated

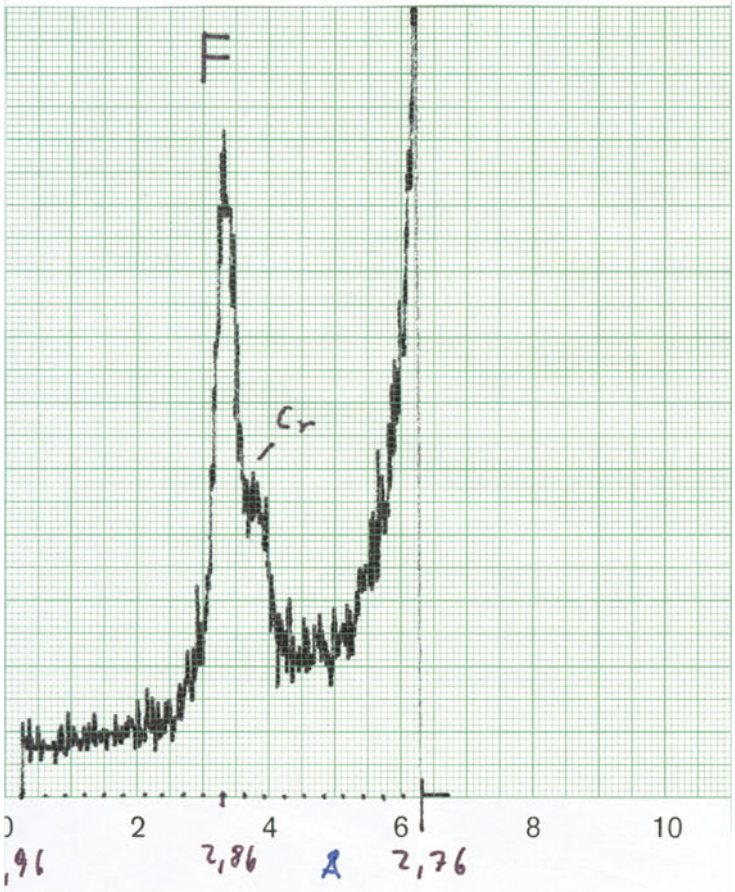

Diagram 2
Microanalytical evaluation of cylinder liner surface material with HIT-FLON®, fluorine demonstrated