FriCSo
Friction Control Solutions

Surface treatment using Polymer Lapping Technology

- Significant reduction of friction losses
- Creation of an oil retaining layer in the surface
- Alternative and/or improvement to coated surfaces
- NON TOXIC

2006 FROST & SULLIVAN Technology Innovation Award

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FriCSo overview

- American - Israeli company: offices in Detroit & Haifa
- Experienced team
- Sales & Marketing activities in US, EU & Asia
- Under evaluation by over 40 major automotive & heavy industry corporations

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Our Technologies

Nanolayer based surface treatment technology that significantly reduces friction between moving parts

- Applicable for:
  - Automotive engine and out of engine parts (e.g. cylinder liners, pistons, piston pins, rocker shafts, cam shafts, shock absorbers, etc.)
  - Hydraulics
  - Aerospace
  - Marine
  - Windmills
  - Healthcare (artificial implants)

FriCSo Technologie

The activation of the surface, due to the polymer lapping, will take place in the first µm to nm on the surface. This means that the polymer lapping process is performed as the last mechanical treatment step (finishing)

Quelle: MTZ 3/2002, Jahrgang 63

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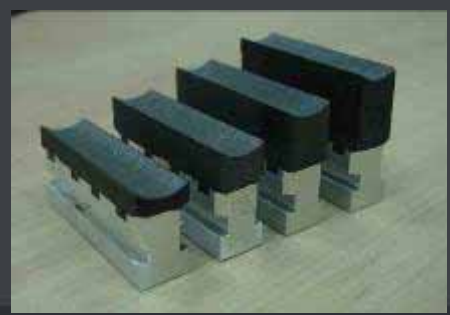
Our Products & Surface Engineering Treatment (SET)

Polymer-based devices, utilizing existing in-line, mass production machines

- Replacing the existing tools with FriCSo Polymer Devices
- Using abrasive paste
- Surface texturing is added in certain applications



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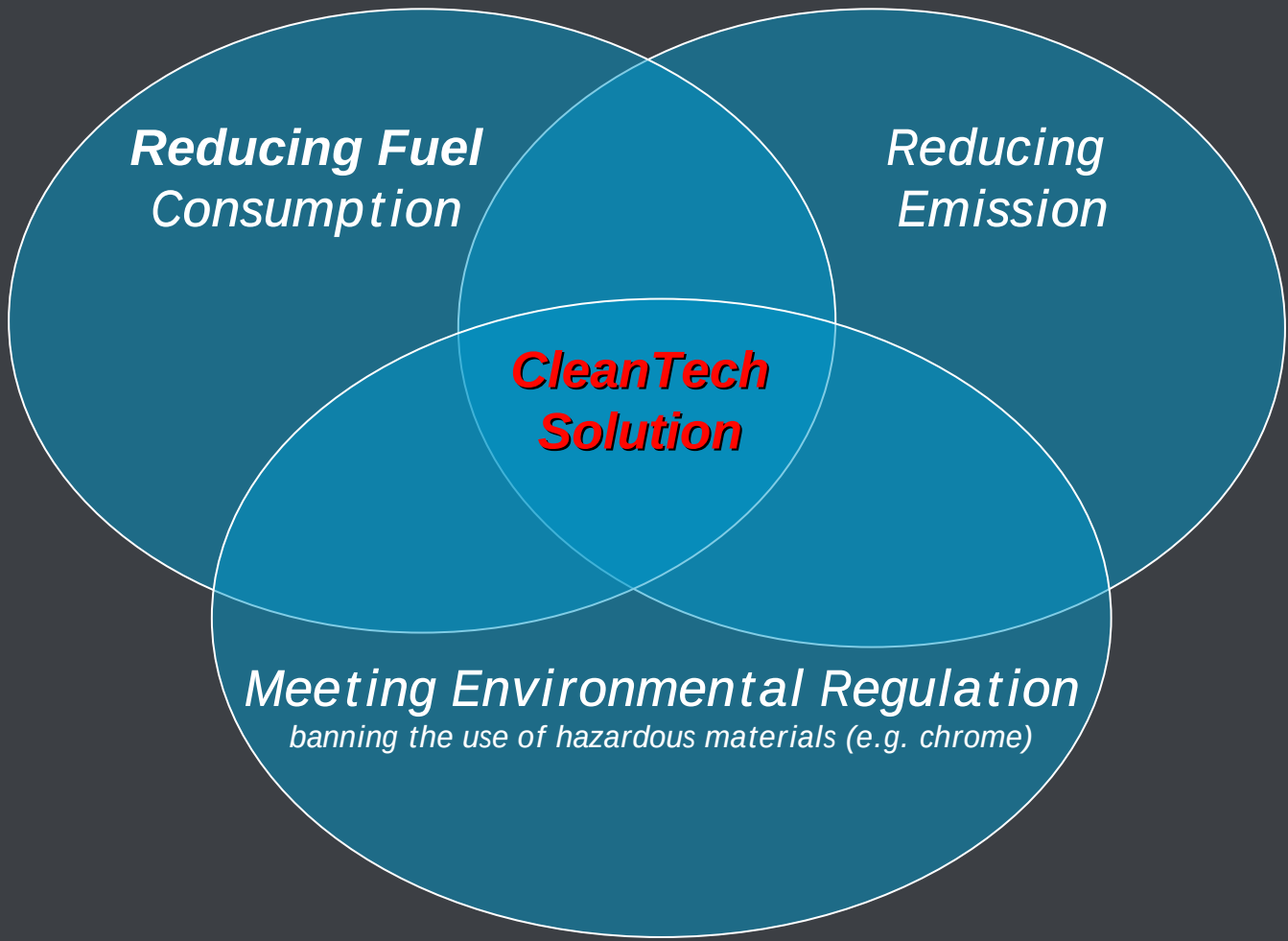
Our CleanTech Solution



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Surface Engineering Treatment (SET)

Application specific treatment

One Step treatment	Two Step Treatment	Two Step Treatment
Lapping only	Grooving + Lapping	Laser Dimples + Lapping
SET-1	SET-2	SET-3

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SET1 - Polymer lapping (One Stage Process)

By applying the FriCSo polymer lapping method, a nanometric organic „active“ layer is formed which is chemically bonded into the metal surface of the treated part.

The unique characteristic of the organic layer is that it dramatically improves the oil retention characteristics of the treated surface while improving the surface topography of the part.

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SET2 – Grooving + Polymer lapping (Two Stage Process)

Surface texturing is done by using diamond tip (plastic deformation)
Texturing process is computer controlled. Surface texture depends on application.

SET2 – Grooving + Polymer lapping (Two Stage Process)

AFTER texturing – BEFORE Polymer-Lapping

Mitutoyo Surftest SJ-400

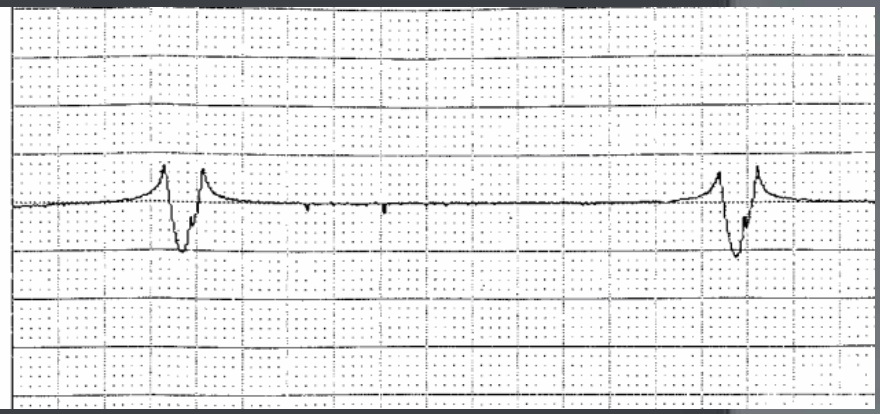
DATE 16-04-2007
TIME 12:07:37
MEMO: PIN

P-PROFILE
EVA-L 10.0mm
L 10.0mm

Pa 0.456μm

P-PROFILE
EVA-L 10.0mm
L=10.0mm
×1K
×10

Ver. 10.0μm/cm
Hor. 1.0mm/cm



AFTER texturing – AFTER Polymer-Lapping

Mitutoyo Surftest SJ-400

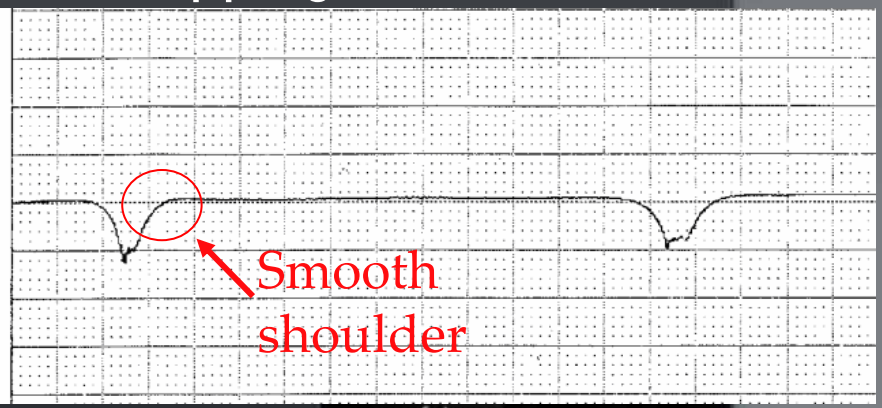
DATE 16-04-2007
TIME 12:20:26
MEMO: PIN

P-PROFILE
EVA-L 10.0mm
L 10.0mm

Pa 0.727μm

P-PROFILE
EVA-L 10.0mm
L=10.0mm
×1K
After PL ×10

Ver. 10.0μm/cm
Hor. 1.0mm/cm



SET3 – Dimples + Polymer lapping (Two Stage Process)

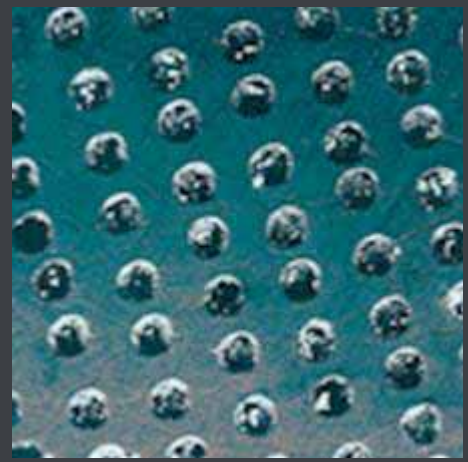
Technical Details of laser dimples:

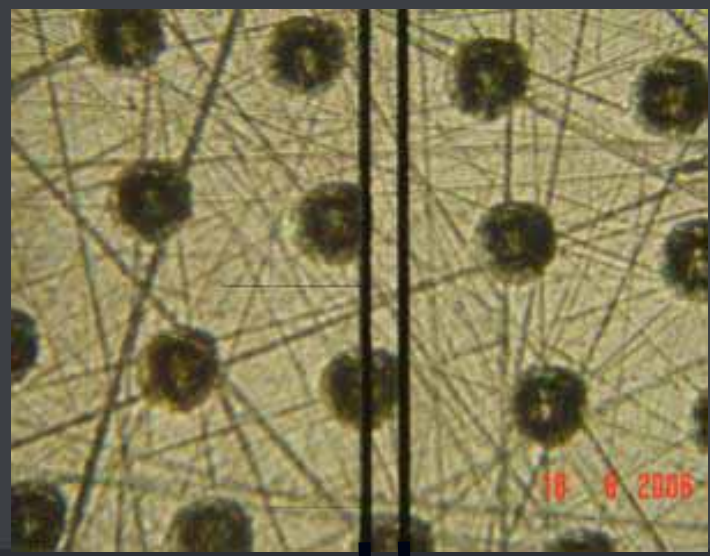
Diameter: 30µ - 120µ

Depth: 1µ - 30µ

Covered area: 1% - 60%
(2 different versions of texturing method)

Polymer-Lapping:
After applying the laser Dimples it is essential to remove sharp edges by polymer lapping





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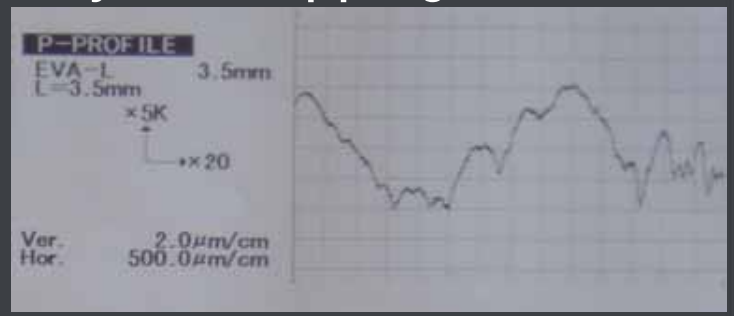
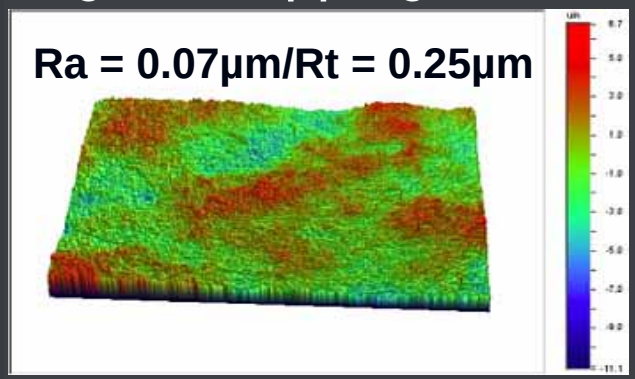
Surface Geometry and Surface Topographie

Geometry BEFORE Polymer-Lapping

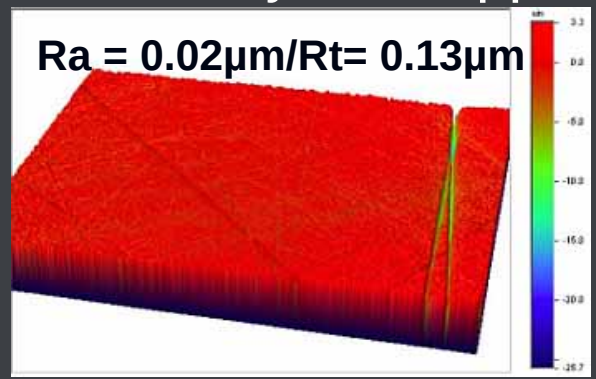
Geometry AFTER Polymer-Lapping



Topographie Regular Lapping



Topographie FriCSo Polymer Lapping



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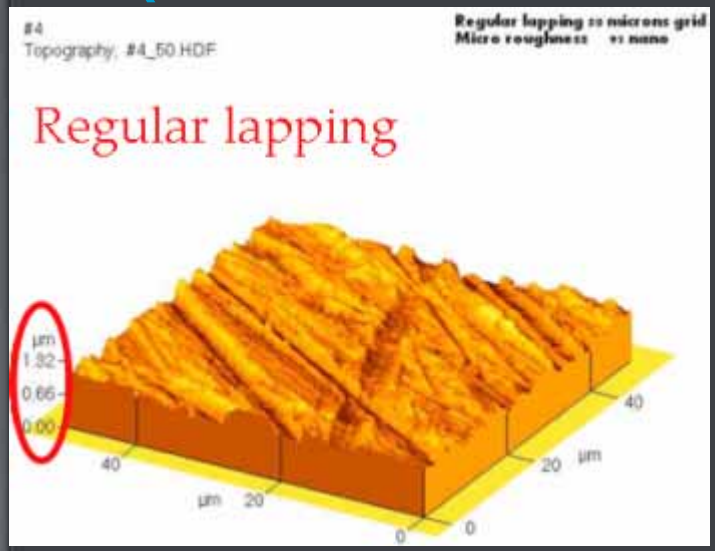
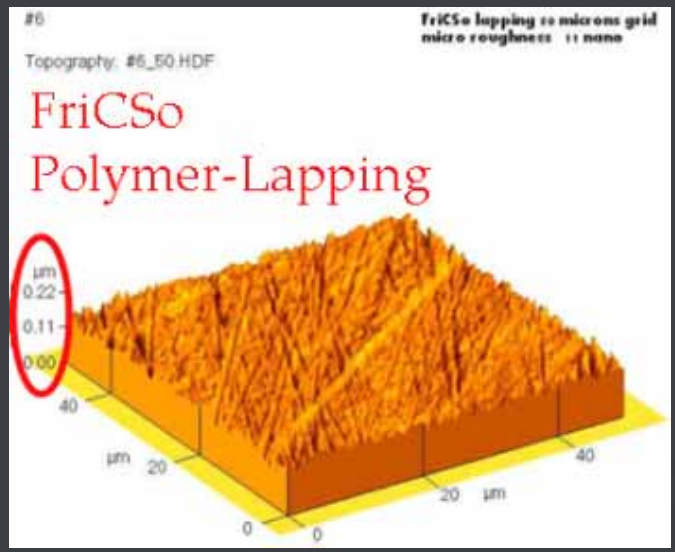
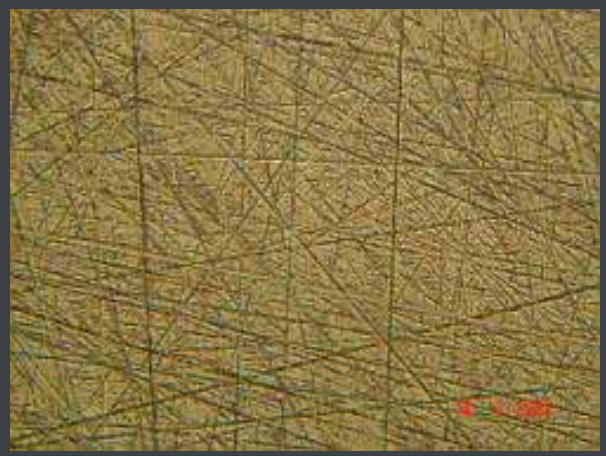
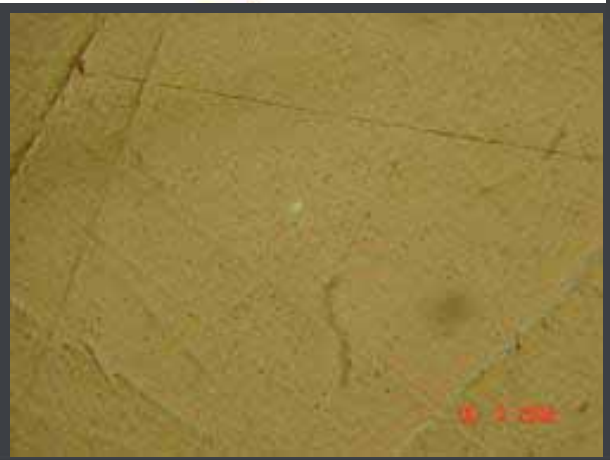
Topography regular lapping vs polymer lapping- AFM (Atomic Force Microscope)









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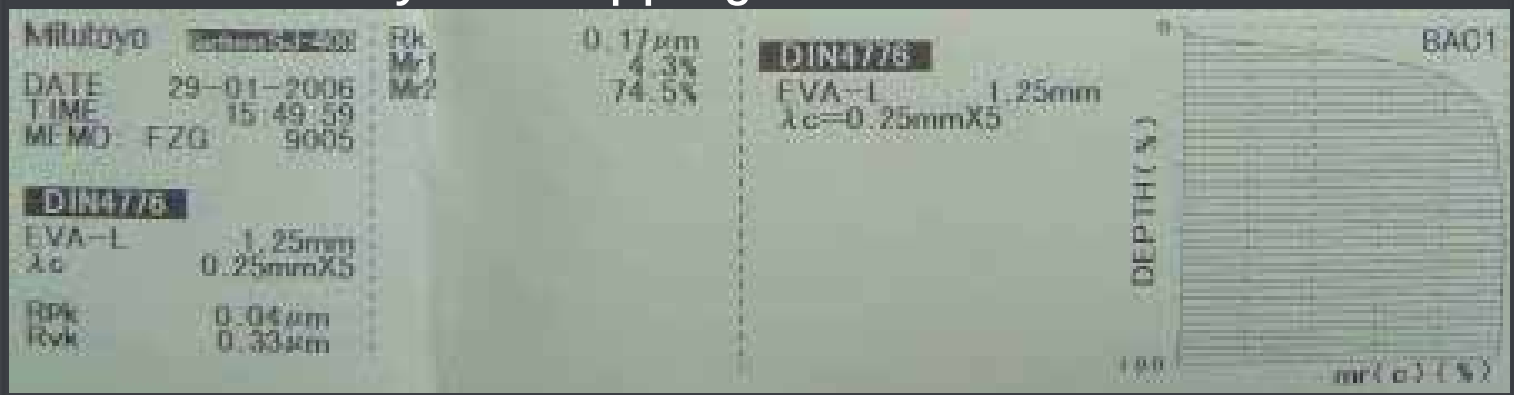
Bearing Area Curve (BAC)

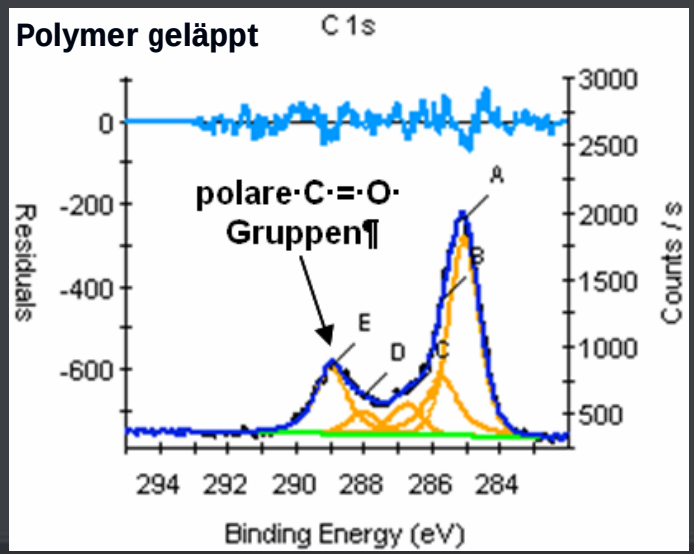
BAC BEFORE Polymer-Lapping

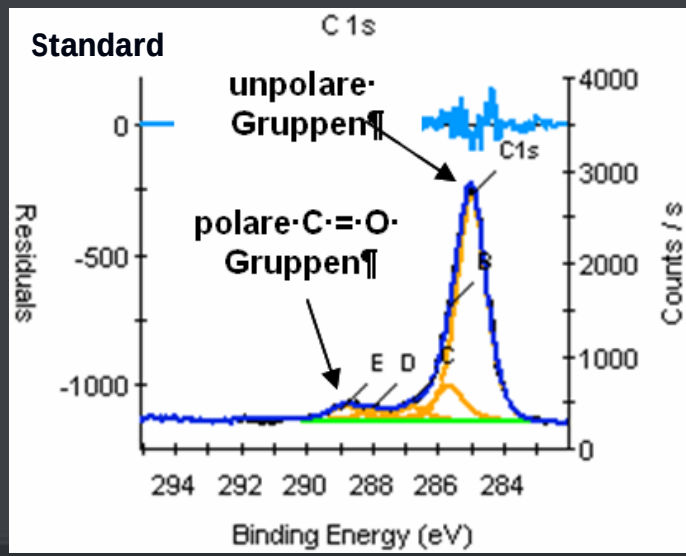
BAC AFTER Polymer-Lapping



FriCSo "Finger-Print" (XPS)

The carbon C1 signal of the polymer lapped sample (left) reveals a significant increase of polar C=O/COOH groups in the upper surface layers compared with C1s signal of the regular lapped steel sample (right)





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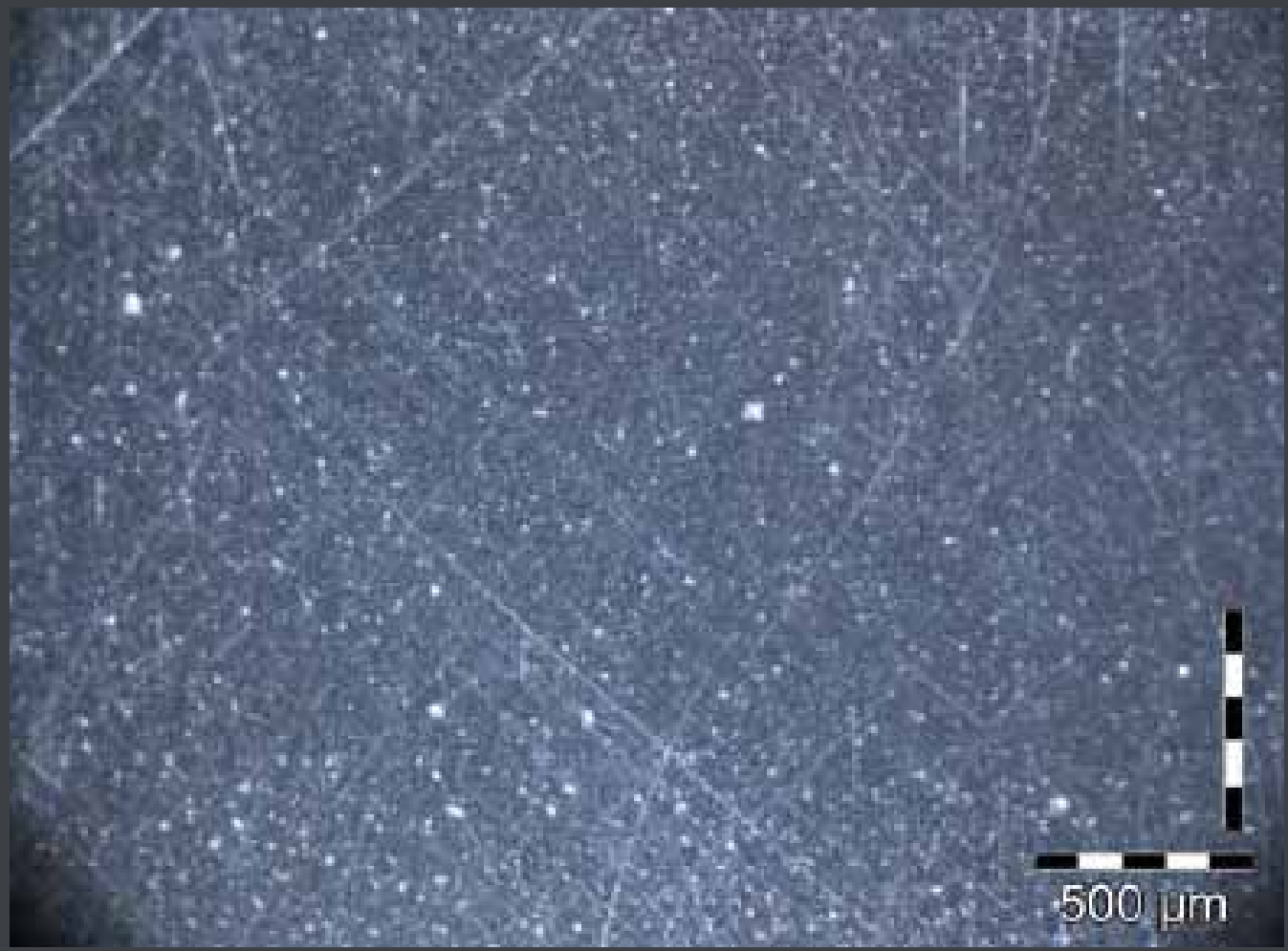
FriCSo “Finger-Print” (optisch)



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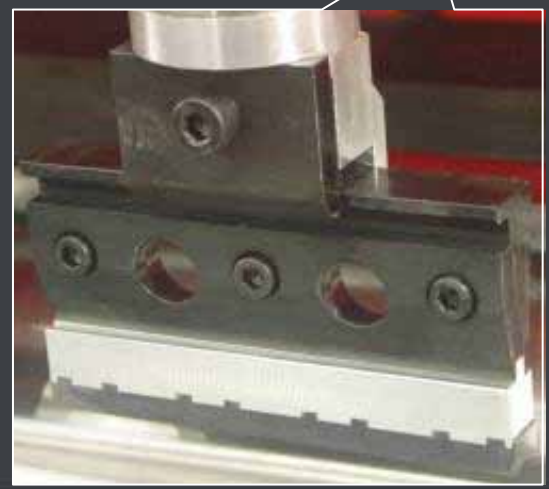
Polymer-Lapping devices for AD / ID

FriCSo polymer lapping is suitable for mass production machines.



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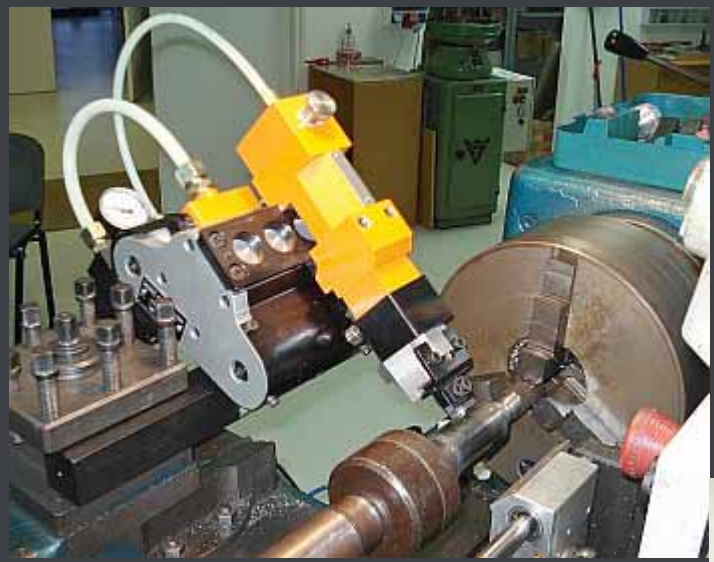
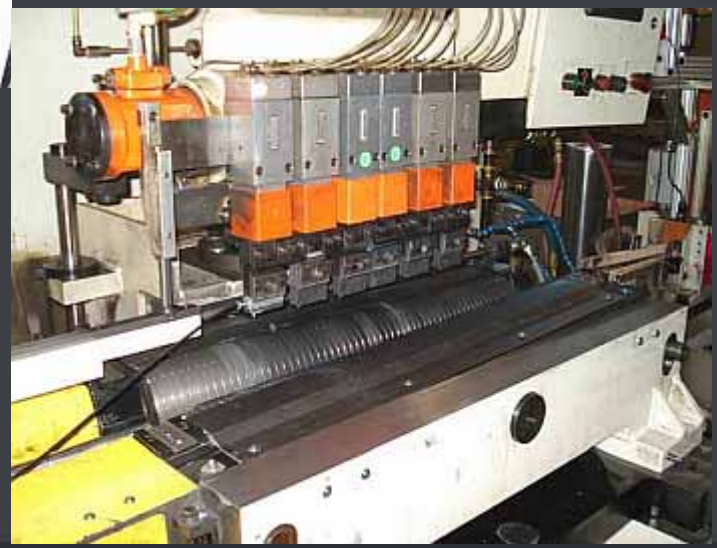
Adaption to machines





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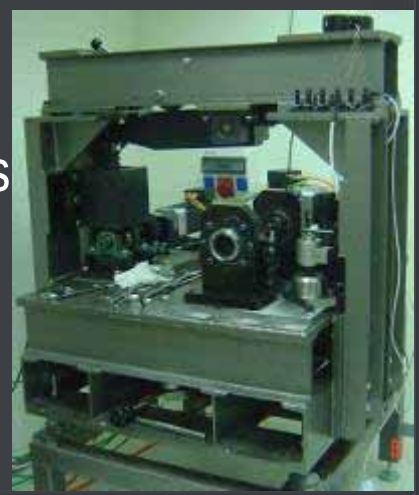
In house Tests

- Roller on Block
- 1 drop of oil
- variable load
- variable speed
- seizure at μ=0.3

- Special testing machine for piston pins
- variable load
- variable speed
- Temp. up to 250°C



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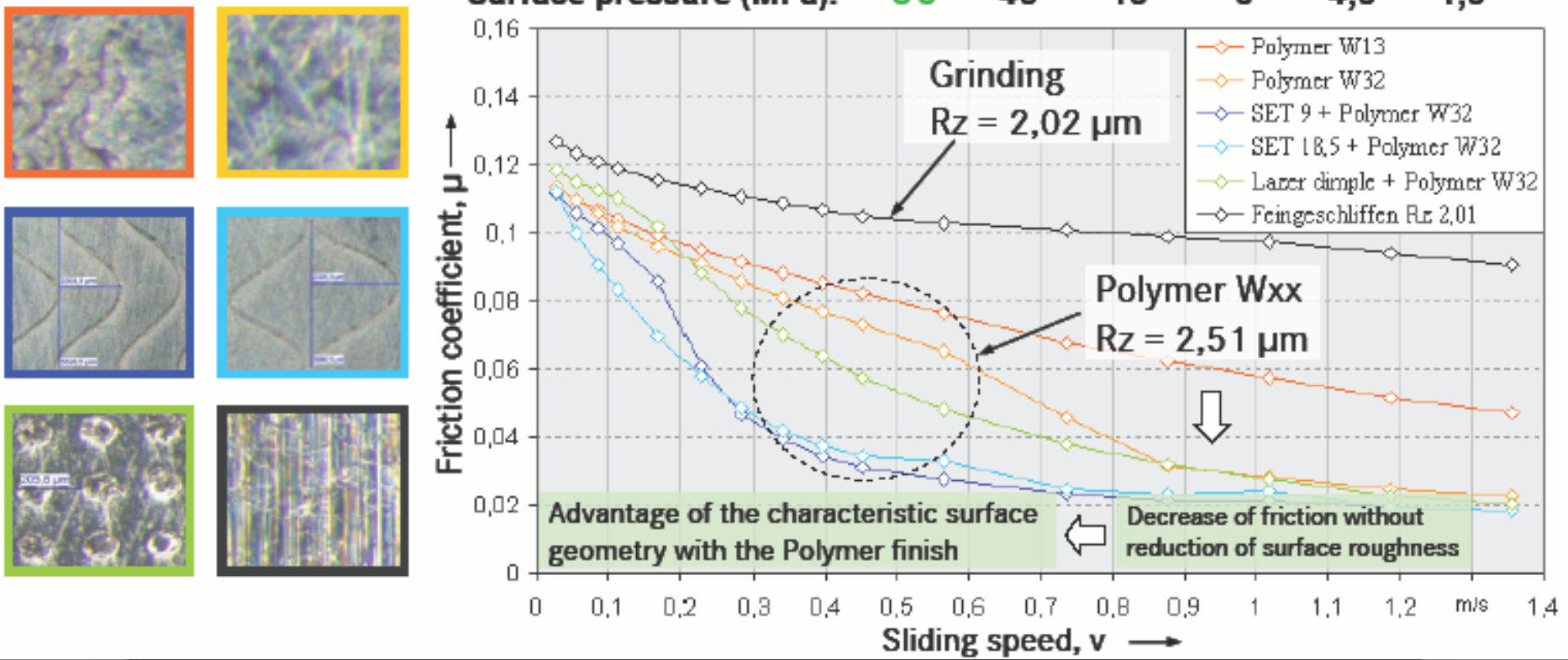
Tribological Investigation: Pin on Disc (COF)



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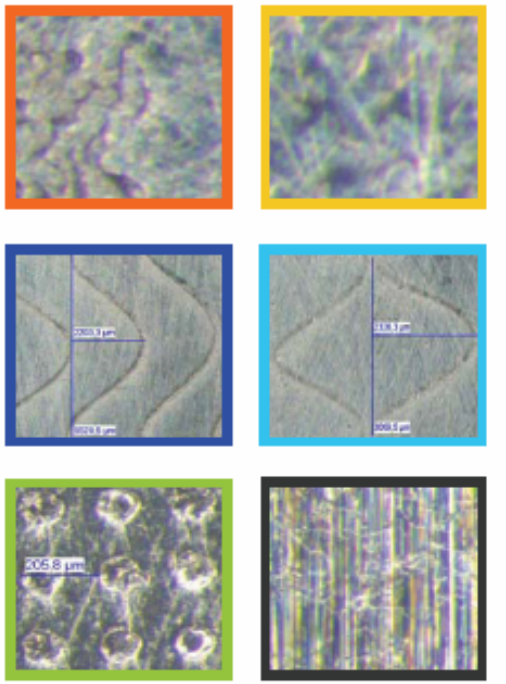
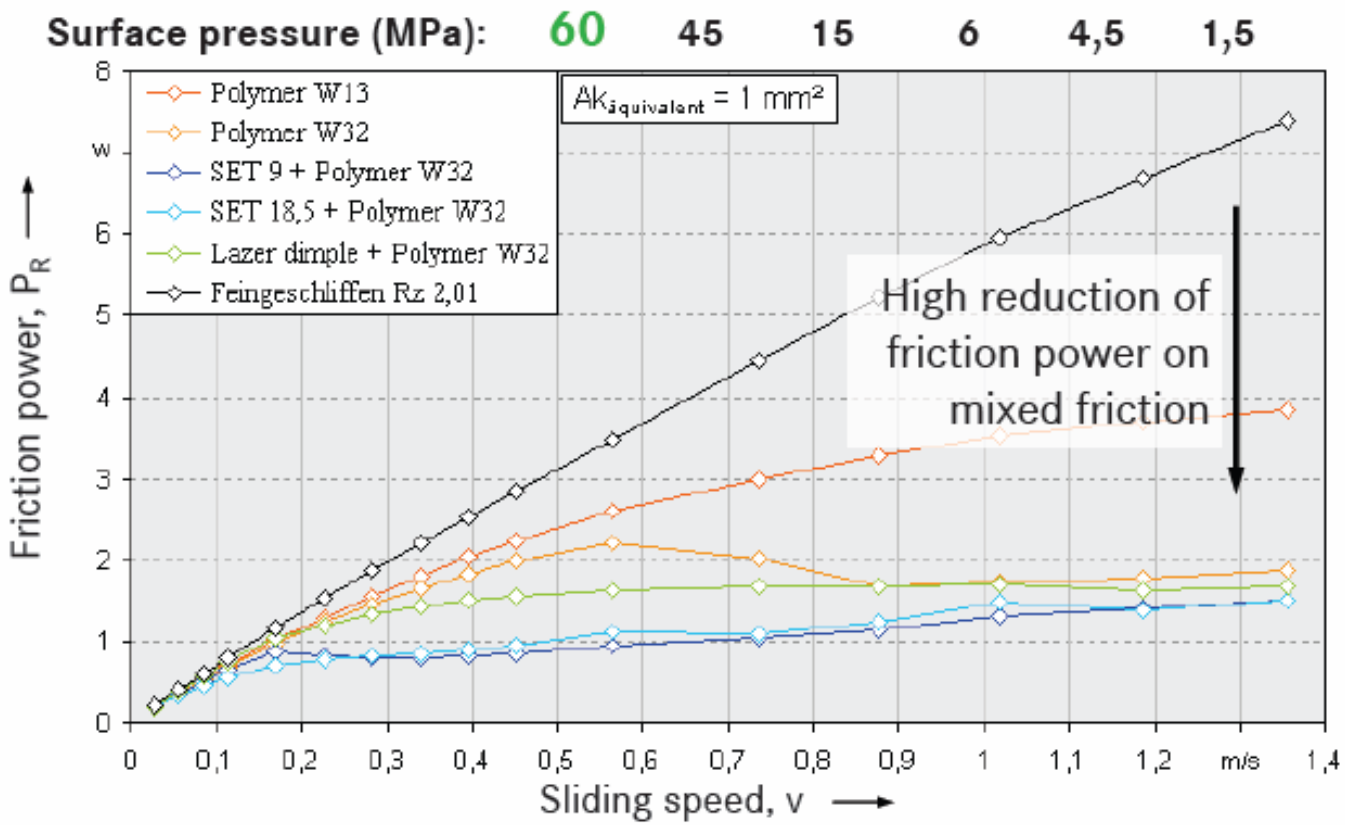
Tribological Investigation: Pin on Disc (friction power)





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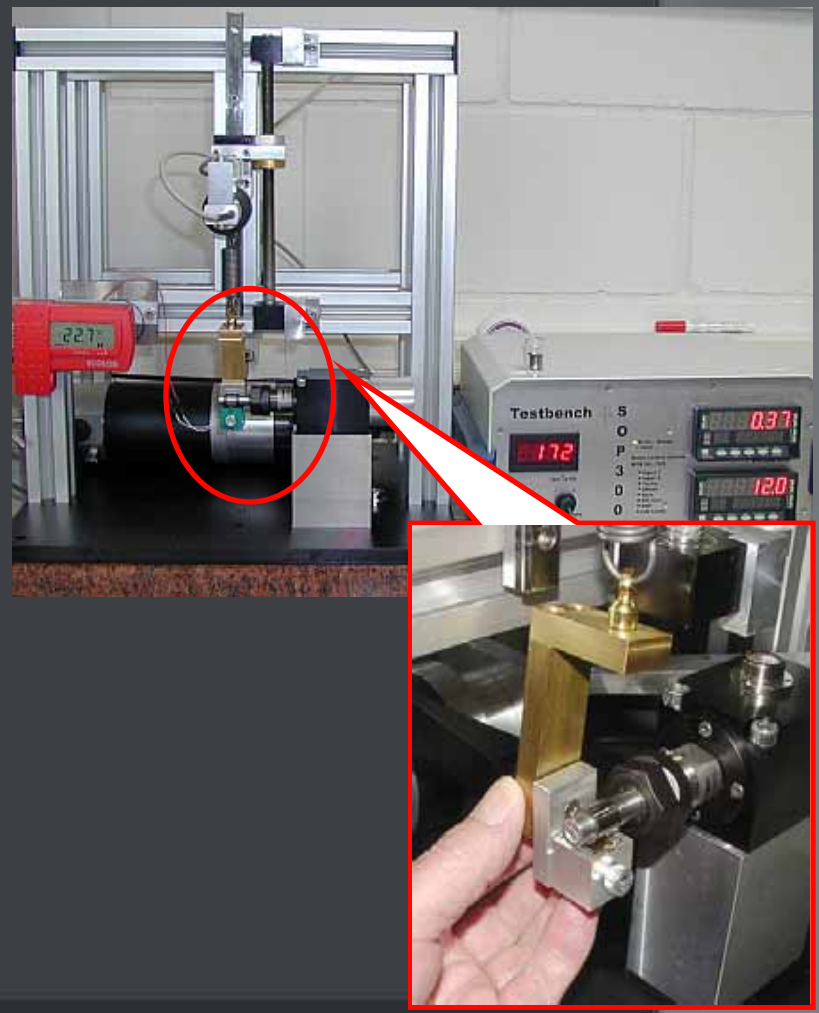
Tribological Investigation : SOP (Shaft on Plate)

Shaft-on-Plate (ISO 7148/2)

Contact: Line, 9 mm
Movement: Rotation
Speed: 18,8 mm/s, (30rpm)
Load: 30 N
Duration: 50 hrs
Sliding Distance: 3391,2m
Room temperature
Lubrication: 100µl parafinic
Mineral oil without additives



Dr. Tillwich GmbH
Werner Stehr

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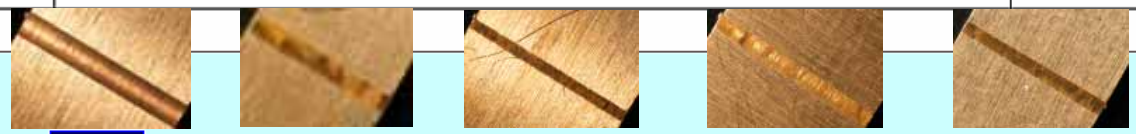
Tribological Investigation: SOP (Shaft on Plate) →Steel vs Brass → Investigation WEAR

Dr. Tillwich GmbH
Werner Stehr
December 2006 SB

TRIBODATA - Friction Test Bench SOP 3000
Steel 100Cr6 (with and without lapping treatments) against Brass
Lubricant: Paraffinic Mineral Oil (100µl), Viscosity 100mm²/s at 20°C
Evaluation of cross section of sliding trace (wear)

Testparameter:
v= 18,8 mm/s
Load 30N
Duration 50h
Temp. RT

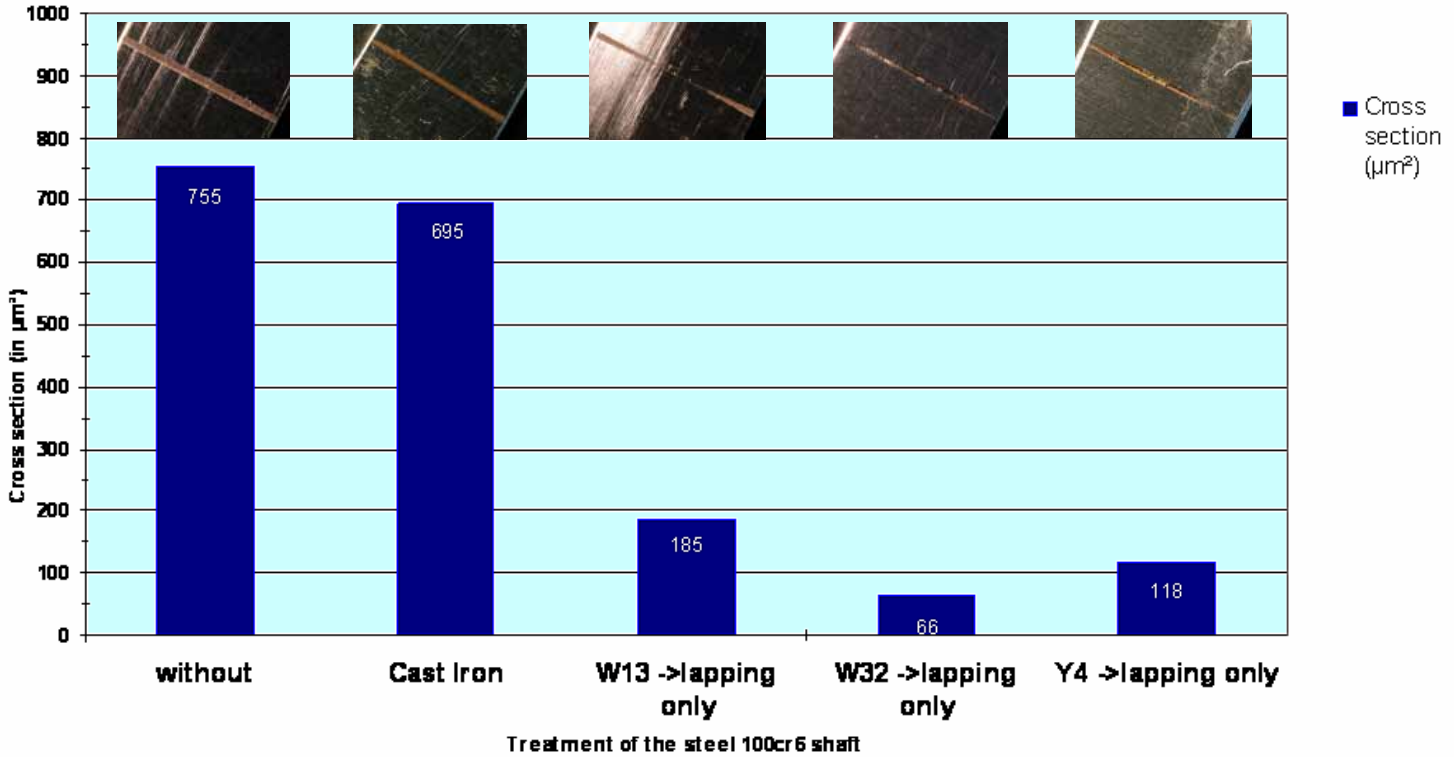


Tribological Investigation: SOP (Shaft on Plate) →Steel vs Steel → Investigation WEAR

Dr. Tillwich GmbH
Werner Stehr
December 2006 SB

TRIBODATA - Friction Test Bench SOP 3000
Steel 100Cr6 (with and without lapping treatment) against Steel
Lubricant: Paraffinic Mineral Oil (100µl), Viscosity 100mm²/s at 20°C
Evaluation of cross section of sliding trace (wear)

Testparameter:
v=18,8 mm/s
Load 30N
Duration 50h
Temp. RT



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Measurement of contact angle

Measurement of wetting angle between applied liquid (water/diomethan) and the surface.

The result shows that the wetting angles of the polymer lapped parts are smaller, which means improved wettability

	Serie		Polymer geläppt	
	Surface Energy [mN/m]	Wetting Angle Theta [°]	Surface Energy [mN/m]	Wetting Angle Theta [°]
Water		99,3 ± 1,56		74,8 ± 1,9
Diomethan		59,3 ± 4,47		55,7 ± 1,42
Dispers Part	28.98		31,07	
Polar Part	0,57		7,80	
Surface Energy	**29,55 [mN/m]**		**38,87 [mN/m]**	

Application: Valve Stem (gooving + polymer lapping)

Running application in the US - motorsports

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Application: Liners

Treatment of liners/full engine blocks – even "high performance surfaces" like Nicasil have been successfully treated

Result : Increase in power output

Before FriCSo treatment

After FriCSo treatment

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Application: Camshaft
Significant reduction in friction-losses on camshaft

The camshaft is structured in on the main bearing and Polymer lapped afterwards.

Results: up to 26% reduction in friction losses in actual working conditions

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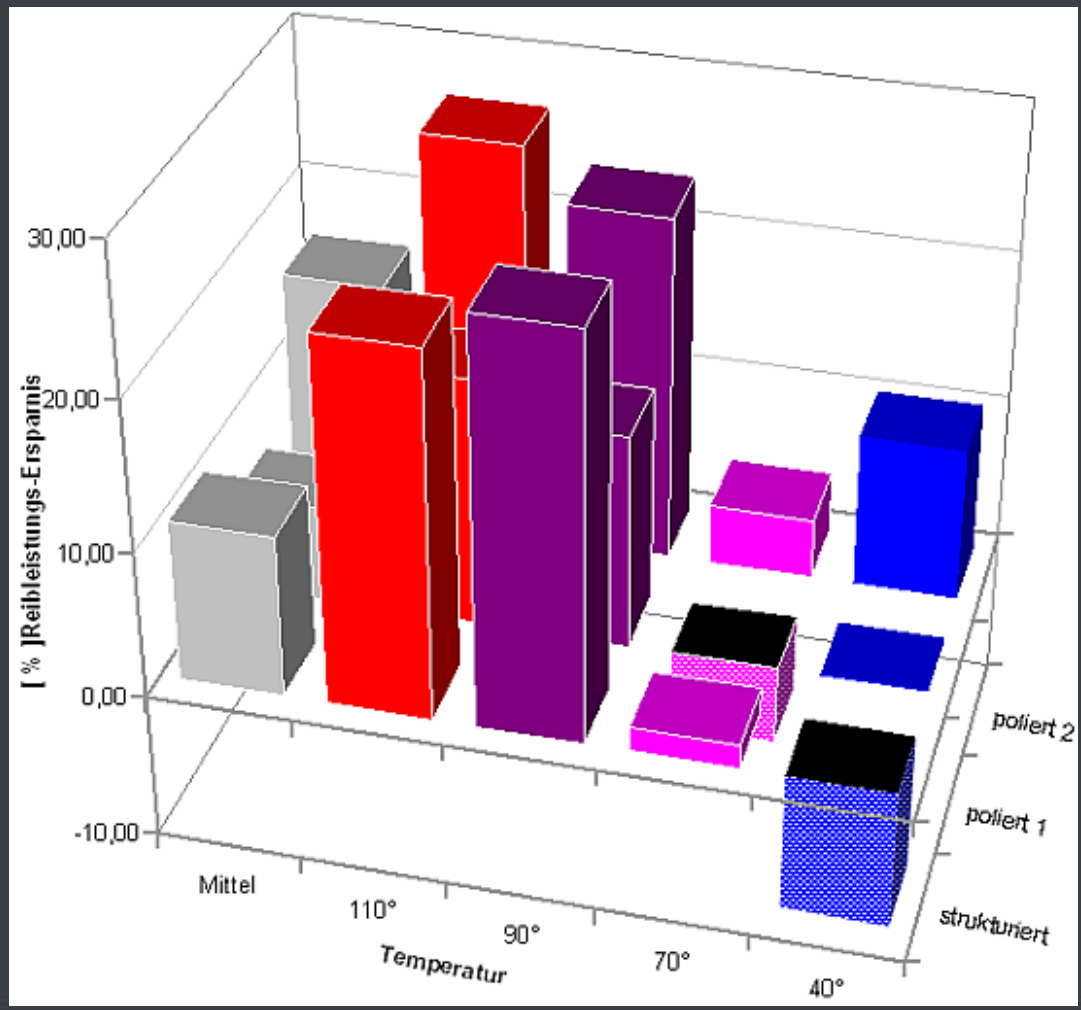
Application: Camshaft
Significant reduction in friction-losses on camshaft



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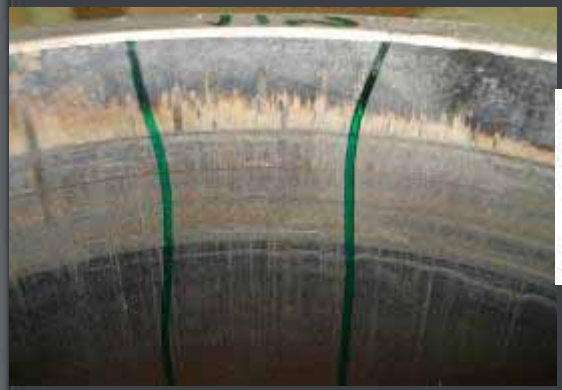
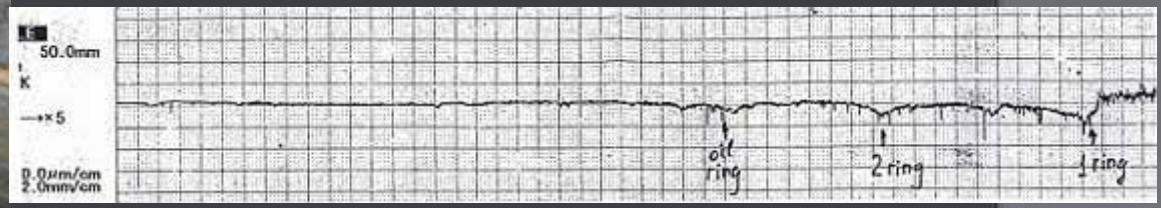
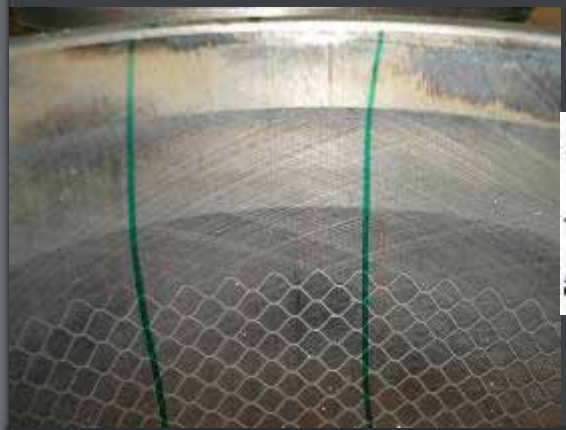
Application: Engine Test (Technion)

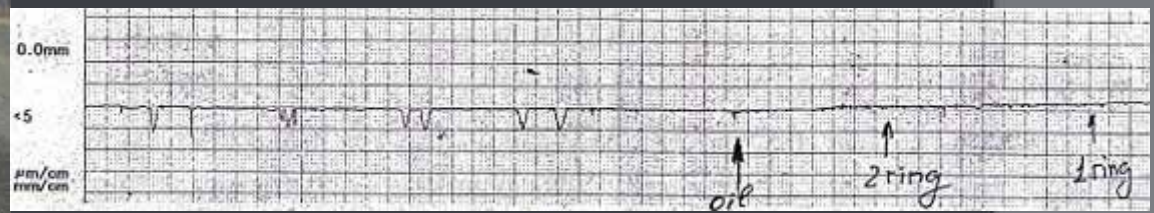
Base line - Standard honing





FriCSo Treatment

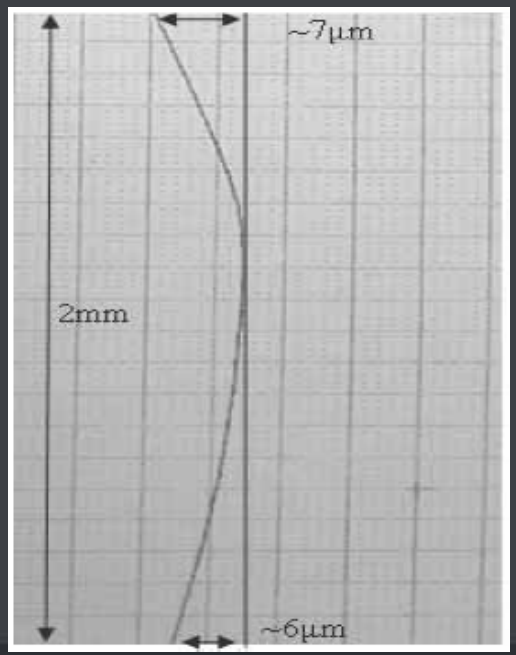




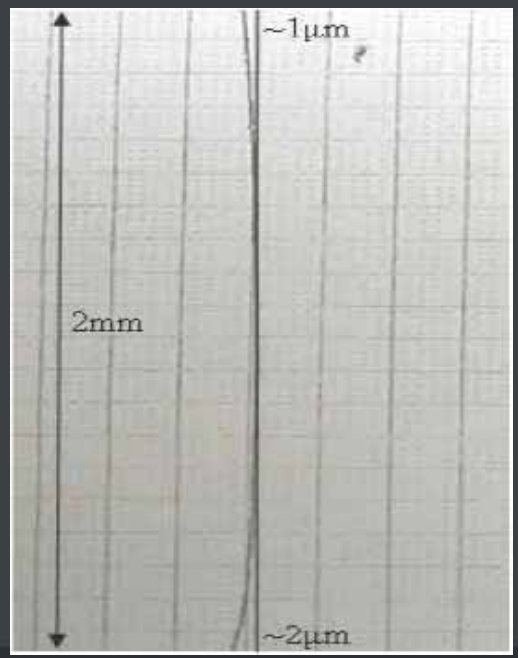
Application: Engine Test (Technion)

1. compression ring

After baseline



After test with polymer lapped engine block



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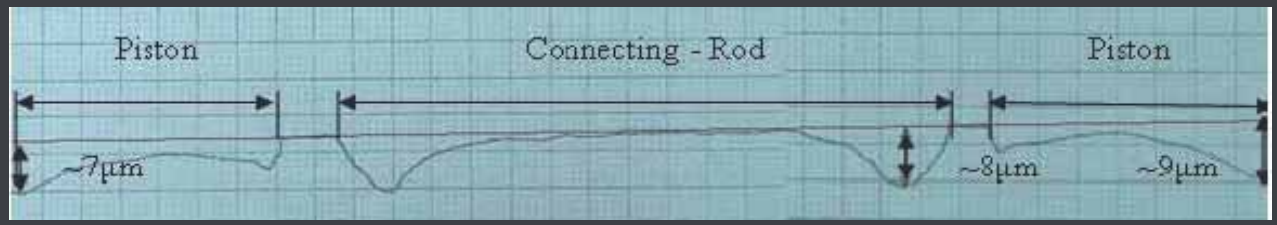
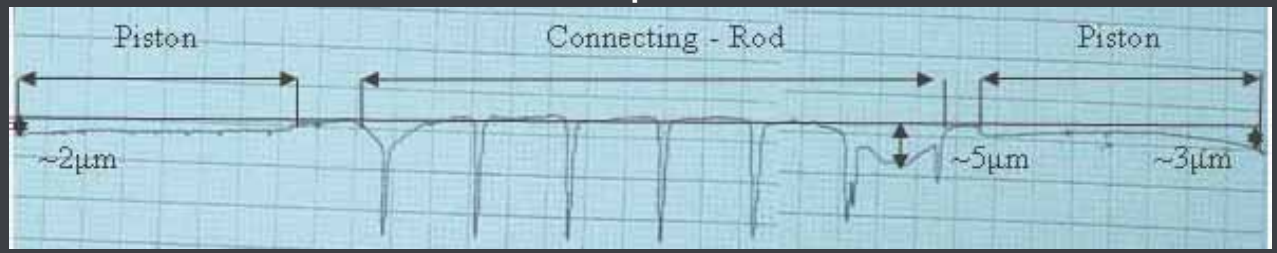
Application: Engine Test (Technion)

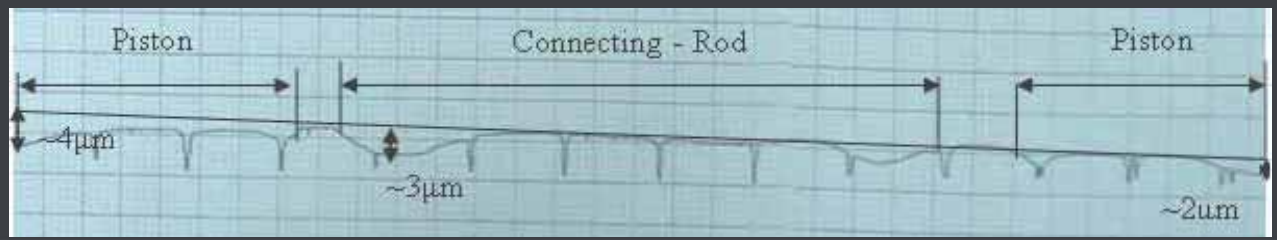
Base line no Treatment – WEAR



FriCSo treatment – WEAR Option1



FriCSo treatment – WEAR Option2



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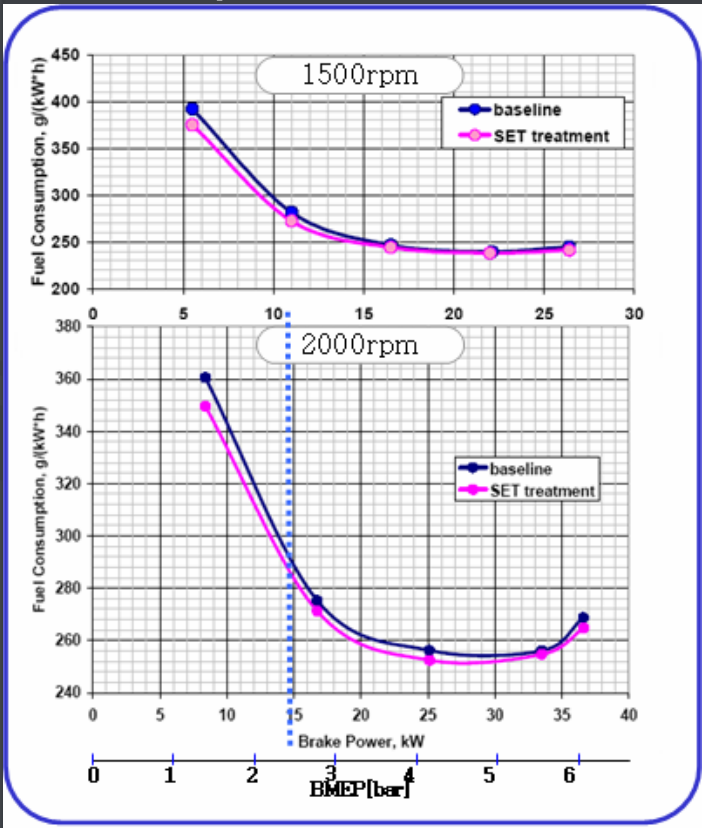
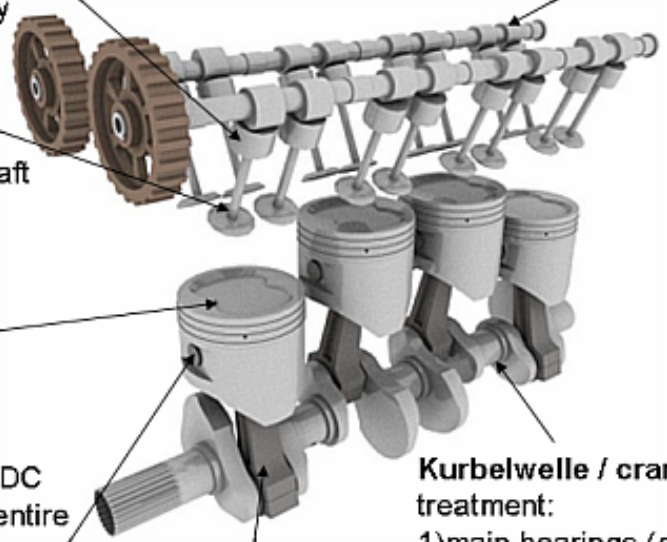
Application: Engine Test (Technion) consumption (BSFC, [g/kwh])

Consumption John Deere



- BSFC reduction of 3% below 15kw

Overview various identified engine components + possible treatments



Tassenstößel / tappets
treatment: lapping only

Ventile / valves
treatment:
valve stem / Ventilschaft
1)structure + lapping
2)lapping only

Kolben / piston
no FriCSo treatment
BUT LINERS
treatment:
1)structure between TDC and BDC + lapping entire length
2)lapping only

Kolbenbolzen / piston pin
treatment:
1)structure in area of conrod‘ + lapping entire length

2)Lapping only
(preparation for coatings)

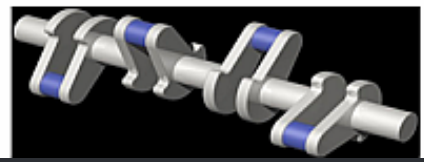
Pleuel / conrod
treatment: under evaluation
(structuring of bearing)

Nockenwelle / camshaft
treatment:
1)main bearings
1a)structure + lapping
1b)lapping only

2)Camlobes/Nocken
2a)lapping only
(difficult to treat ->impact of improvement very low)

Kurbelwelle / crankshaft
treatment:
1)main bearings (grey)
1a)structure + lapping (depends on forces)
1b)lapping only

2)Crank bearings
2a)structure + lapping (depends on forces)
2b)lapping only



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Hydraulic Application – Eliminating adhesion wear

Test Conditions:

-372 bar

-2400 RPM

-180°F

-1,25 Mio. Testcycles

"actual treatment"

"FriCSo Lapping"

FriCSo
Friction Control Solutions

THANK YOU

Besuchen Sie uns auf unserem Stand

Halle: 7
Stand: 8078

FriCSo Germany

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