Combined Standstill Tests (Pre-damaging) and SNR-Tests

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Project aim

The Competence Center Tribology investigates the extent to which it is possible to positively influence existing standstill marks during further operation by adding the Rewitec additive.
For this purpose, tests are run on the false-brinelling test bench. The bearings are pre-damaged in a preliminary test with very small swivel angles (+/- 0.5 °). Then the swivel angle is increased so that the markings are rolled over (+/- 3 °).

Tested lubricants: Stabyl LX460 without and with Rewitec addition (samples provided by the client)

False-Brinelling-Test-Rig

Test Rig

Test specimen

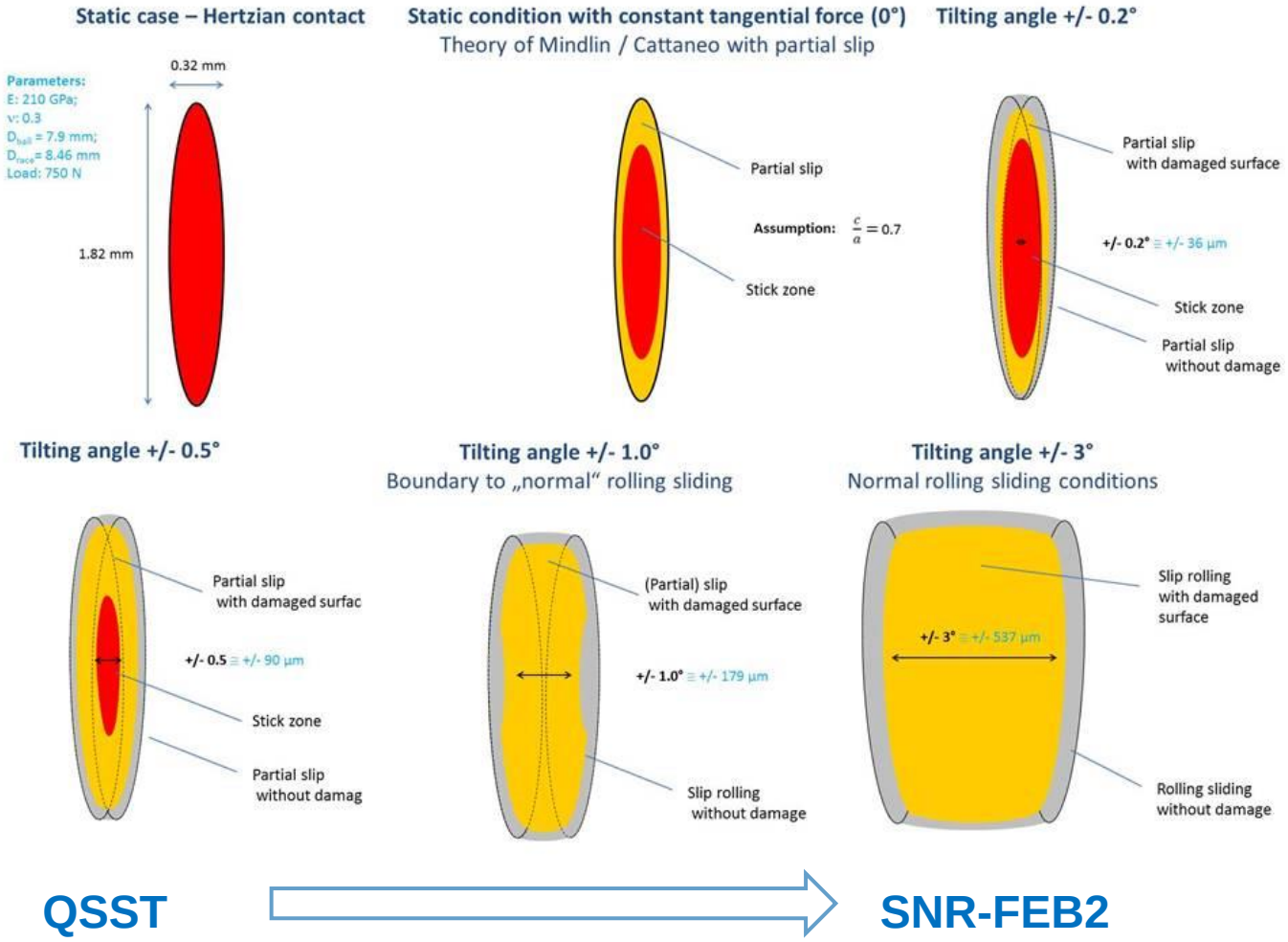
Data

Motor:	**3kW/ 20,3 Nm**
Oscillating Angle:	**±0,1° till ± 3,0°**
Oscillating Frequency:	**5 - 25 Hz**
Normal Load:	**100 till 9000 N**
Standardized Test Period:	**1 min until 100 h**

Data Bearing Type 51206

Diameter:	**41 mm**
Weight:	**136 g**
Material:	**100Cr6**
Hardness:	**62 +/-2 HRC**

Sketch: Influence of the tilting angle on the contact area



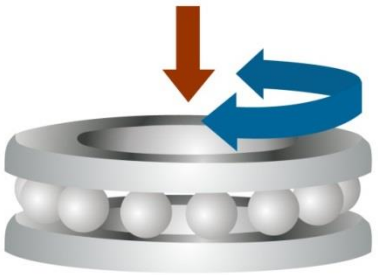
QSST → **SNR-FEB2**

Experimental Details

General

Test parameters:

- Frequency: 24 Hz
- Amplitude: SNR-FEB2-test +/- 3°; standstill-test +/-0.5°
- Load: SNR-FEB2-test and standstill-test 3000 N on 4 balls
- Temperature: 22°C +/- 2°
- Time: SNR-Test 3 h ; Standstill-Test 6 min; The normal run time for the SNR-FEB2-test is 50 hours but it was clear that this grease fails after latest 5 hours, so the test period was reduced
- Bearing type: 51206 (C_{dyn} = 26 kN, C_{stat} = 51 kN)
- Amount of Grease 1.1 g +/- 0.1 g
- Measurement: Optical investigation after test
- Statistics: At least double determination; 8 marks per standstill-test



Test Exekution Standstill-Test

- Removing 8 of the 12 balls
- Cleaning of all bearing parts in an ultrasonic bath with boiling limit spirit
- Drying at air
- Filling of the complete raceways with the test grease (1,0 g / ring)
- Mounting the test bearings in the test rig
- Turning of the bearing 10 times under load (3,000 N)
- Mounting of the connecting rod
- Test start for the planned test period (in this case 6 min.)
- Continuation with the SNR-conditions without dismantling
- Increase of the tilting angle to +/- 3°

Test Exekution SNR-Test after pre damaging

- Increase of the tilting angle to +/- 3°
- Test start for the planed test period (in this case 3 hours)
- Evaluation of the marks

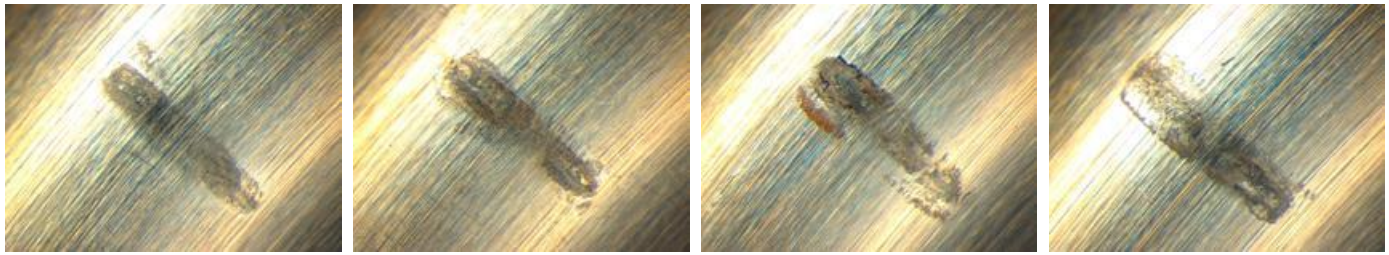

Standstill-Test
(pre damaging)

Standstill test with pure Stabyl LX460 SYN (3 kN; +/- 0,5)

1 min

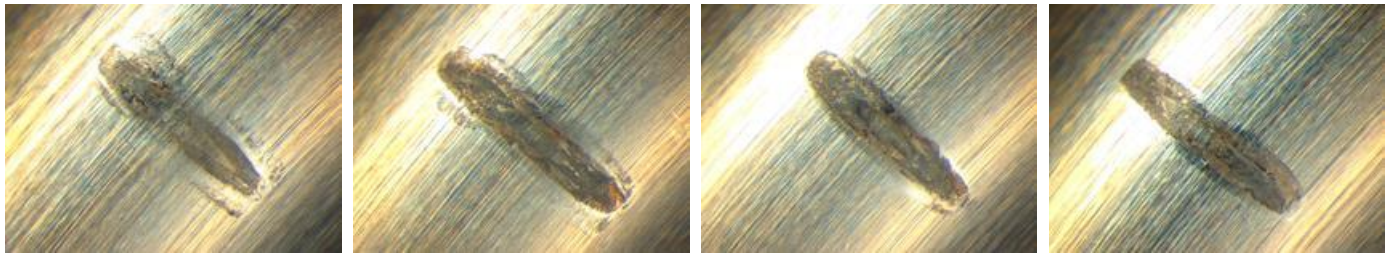
Already clearly visible markings with mild adhesion and significant oxidation.

6 min



Moderate adhesion and average oxidation.

80 min



Significant damage. Medium strong adhesion and significant oxidation.

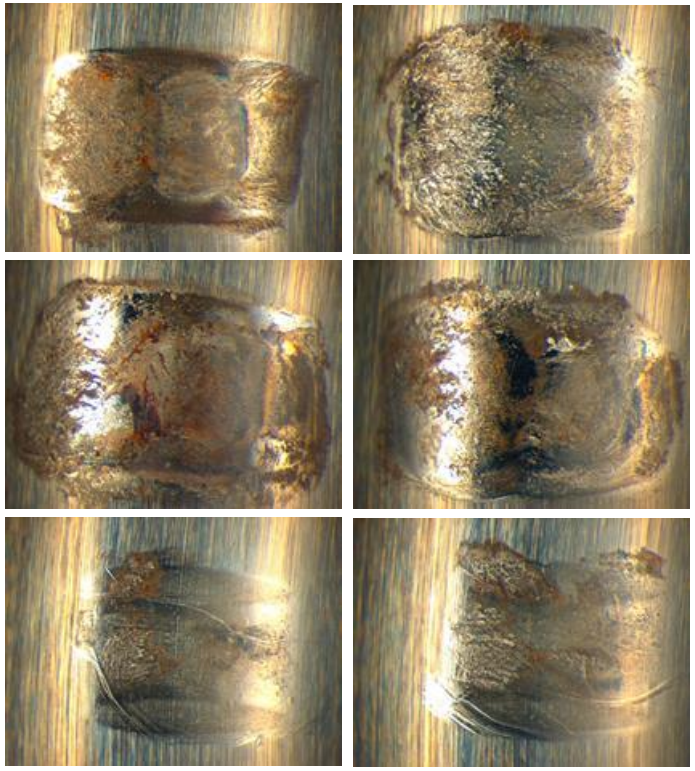
Left unit

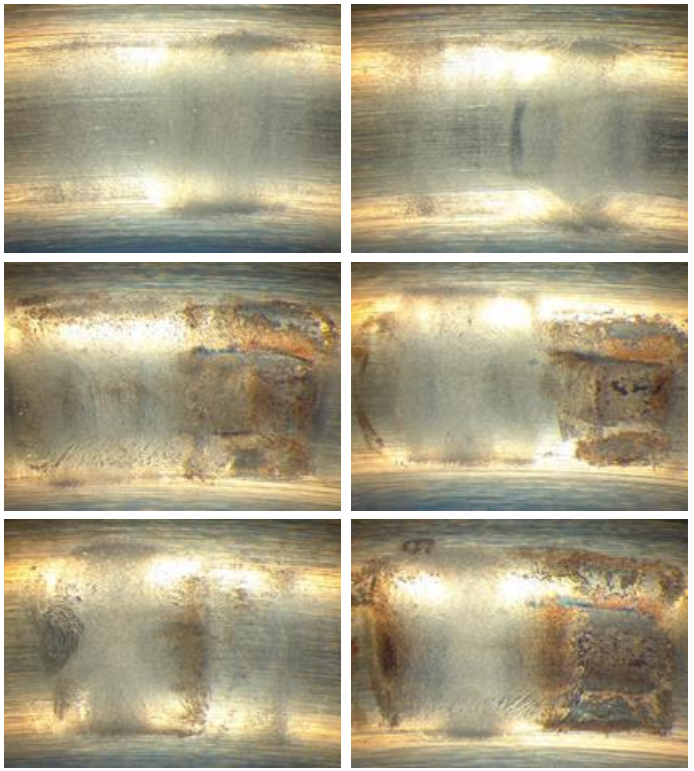
Right unit

Continuation with previously damaged bearings in accordance to the SNR-FEB-2 test

Surfaces after 3 hours with +/- 3 ° after pre-damage 6 minutes (3 kN, +/- 0.5)

Tilting movement (+/- 3°)





Tilting movement (+/- 3°)

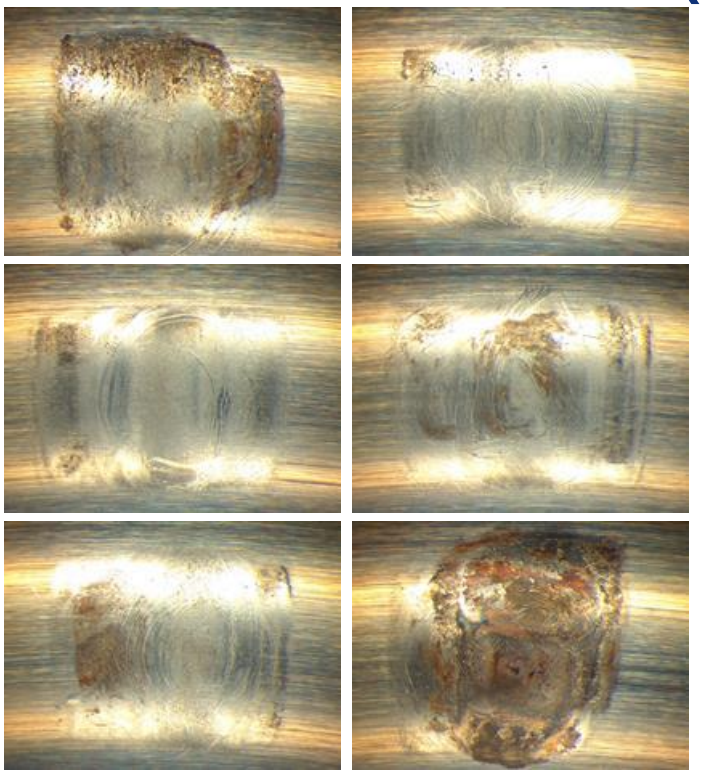
Left unit: **Pure** Grease

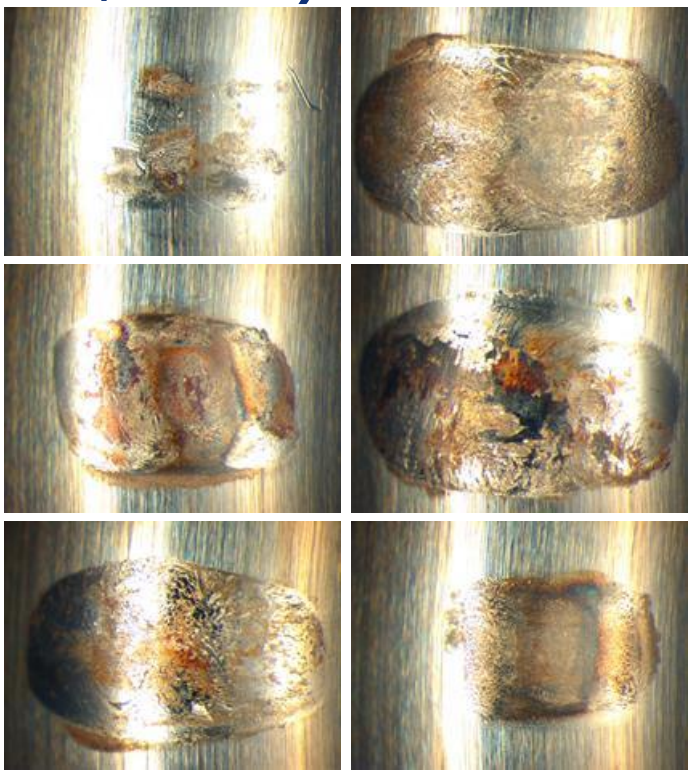
Right unit: **Rewitec**-modified

On the side on which the grease with Rewitec addition was used, the marks are much less damaged. The oxidation in the contact point is significantly lower. In order to have a certain statistical certainty, the tests after this first trial were repeated again in duplicate.

Surfaces after 3 hours with +/- 3 ° after pre-damage 1.3 hours (3 kN, +/- 0.5)

Tilting movement (+/- 3°)





Tilting movement (+/- 3°)

Left unit: **Rewitec**-modified

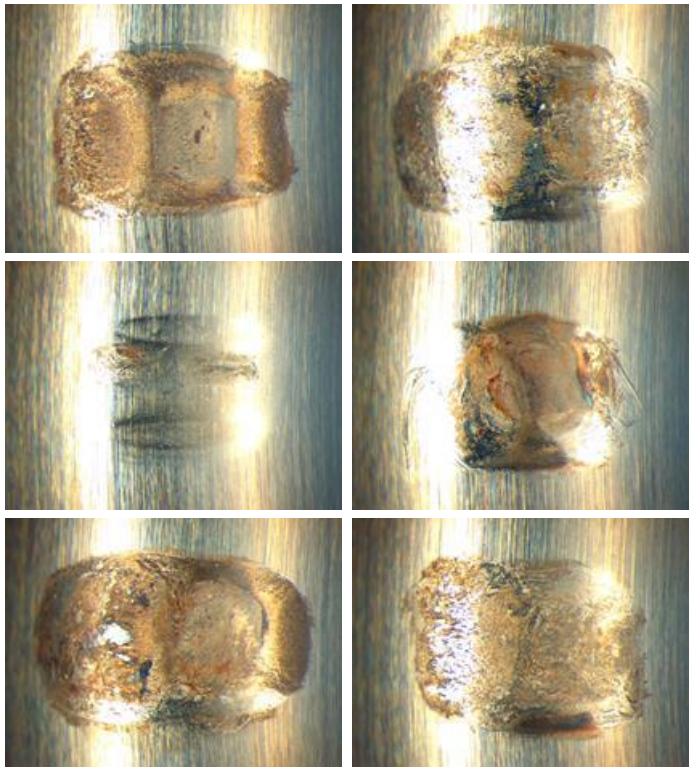
Right unit: **Pure** grease

On the side on which the grease with Rewitec addition was used, the markings are on average again less severely damaged. The oxidation in the contact point is significantly lower.
In the next step, the pre damaging time was increase from 6 minutes to 1.3 hours.

Surfaces after 3 hours with +/- 3 ° after pre-damage 1.3 hours (3 kN, +/- 0.5) – Pure grease - Run 2 and 3

Tilting movement (+/- 3°)

Left unit: **Pure** grease



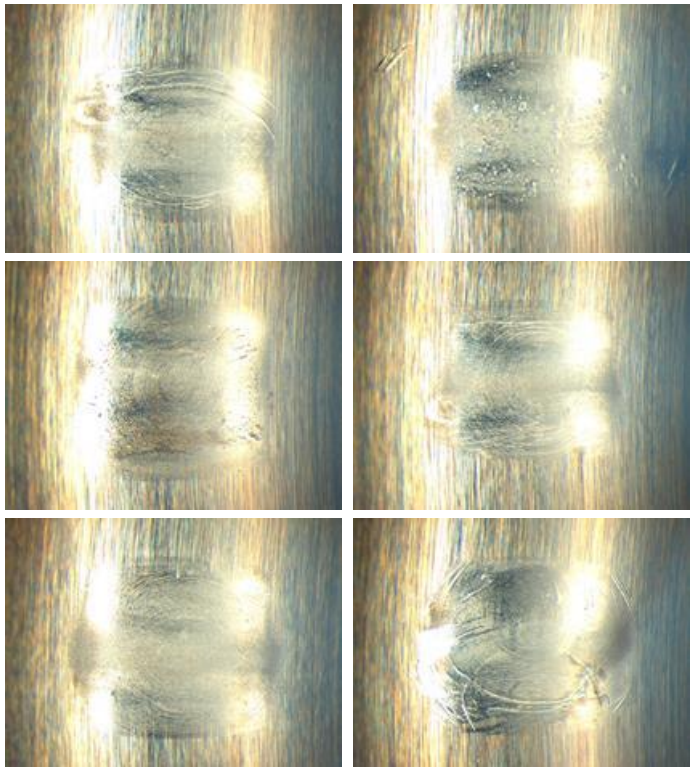
Right unit: **Pure** grease

Tilting movement (+/- 3°)

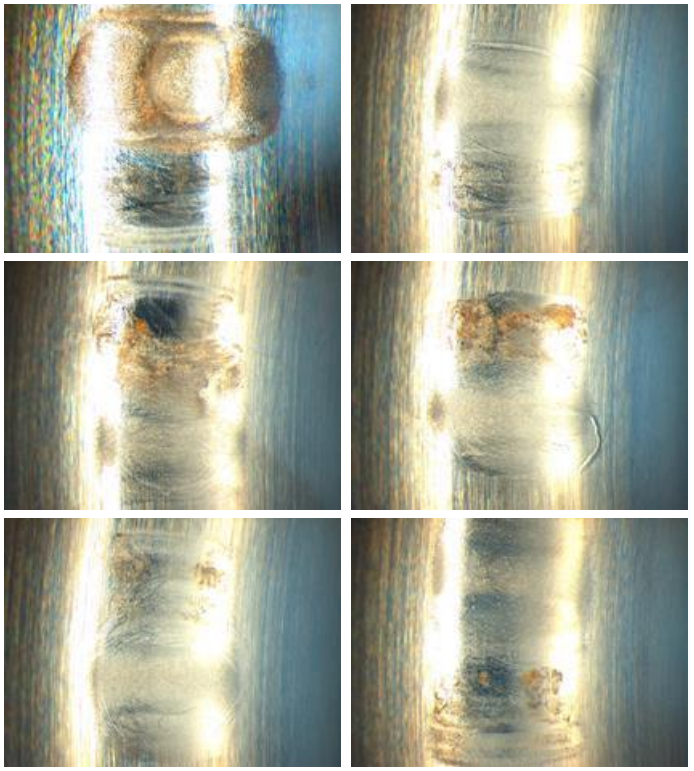
With the standard greases the markings show a clear oxidation. Abrasion particles are plated in the contact zone.

Surfaces after 3 hours with +/- 3 ° after pre-damage
1.3 hours (3 kN, +/- 0.5) – Rewitec modified - Run 2 and 3

Tilting movement (+/- 3°)



Left unit: **Rewitec**-modified



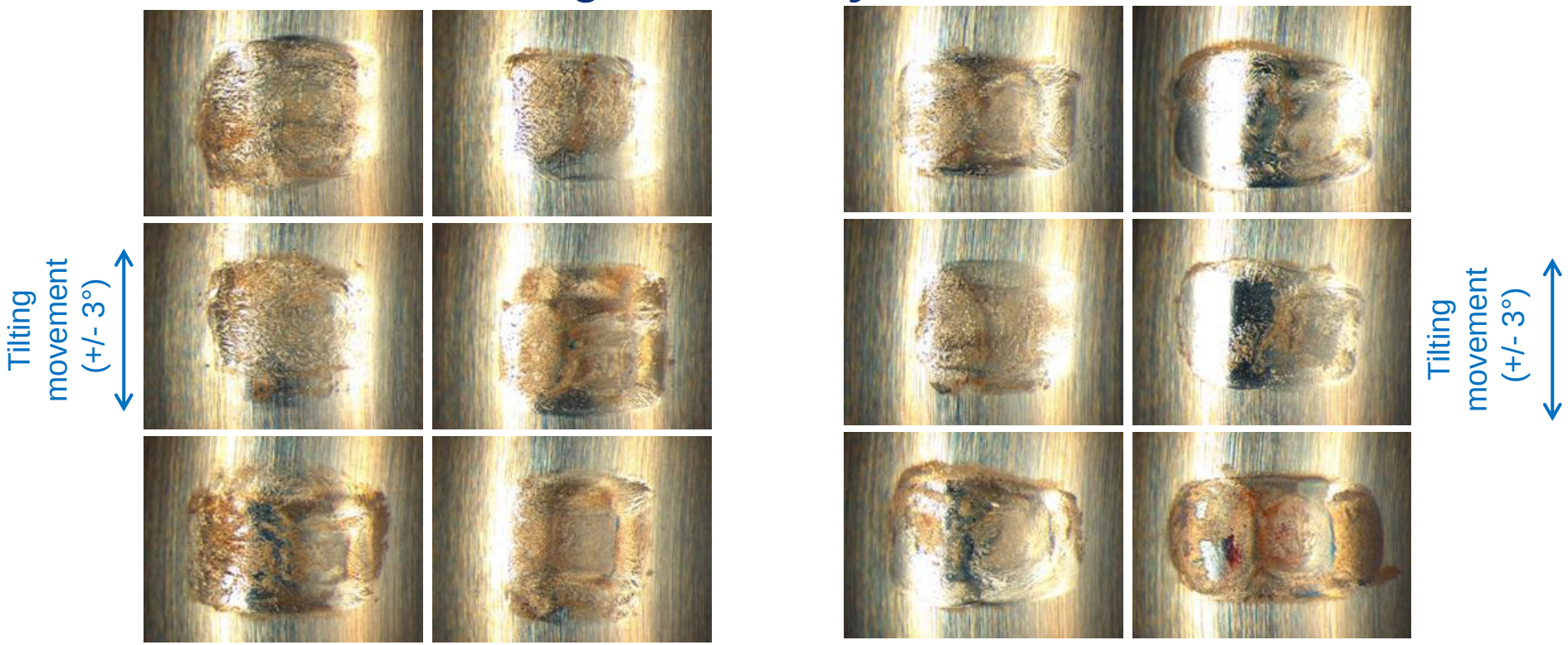
Tilting movement (+/- 3°)

Right unit: **Rewitec**-modified

It can be seen that the marks on average are significantly less damaged when Rewitec is added. The oxidation in the contact point is significantly lower. It hardly recognizes plated wear particles in the contact zone.

Modified SNR-FEB-2 test without pre damaging

Surfaces after 3 hours with +/- 3 ° without pre-damage – Pure grease Stabyl LX 460 SYN

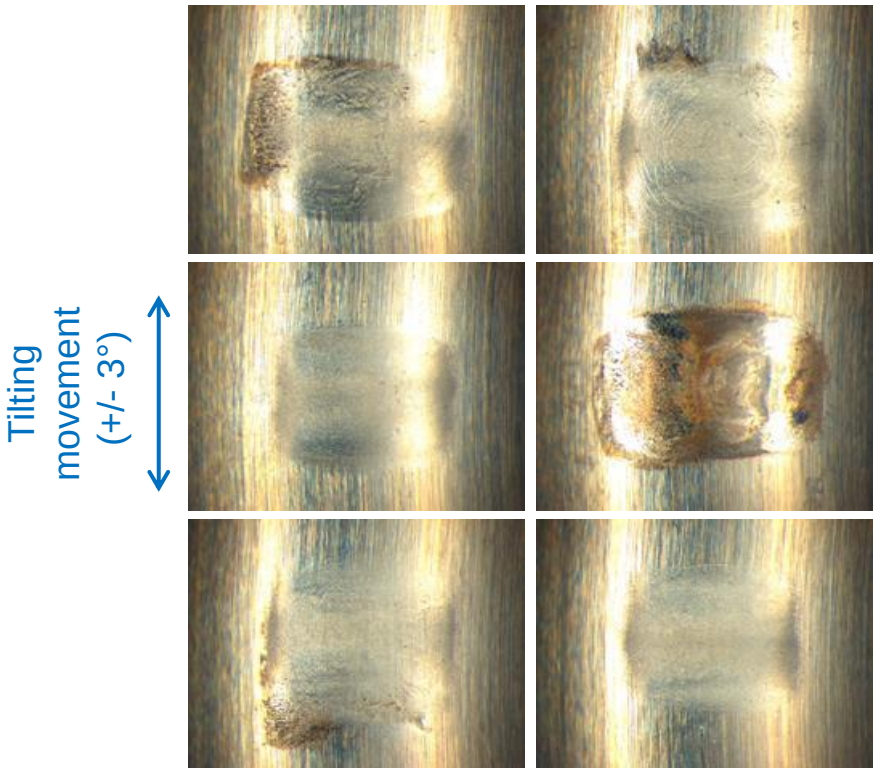


Left unit: **pure** grease

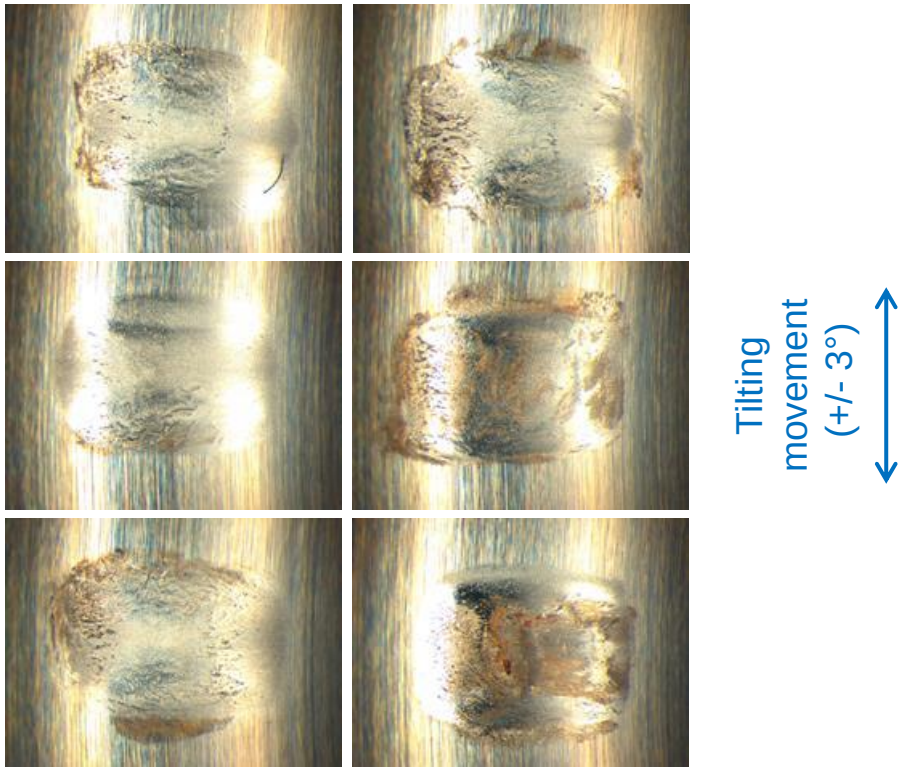
Right unit: **pure** grease

Compared to the test with pre-damaging there are nearly no differences visible. Again there is a stronger oxidation visible compared to the modified grease (next slide).

Surfaces after 3 hours with +/- 3 ° without pre-damage – Rewitec modified



Left unit: **Rewitec**-modified

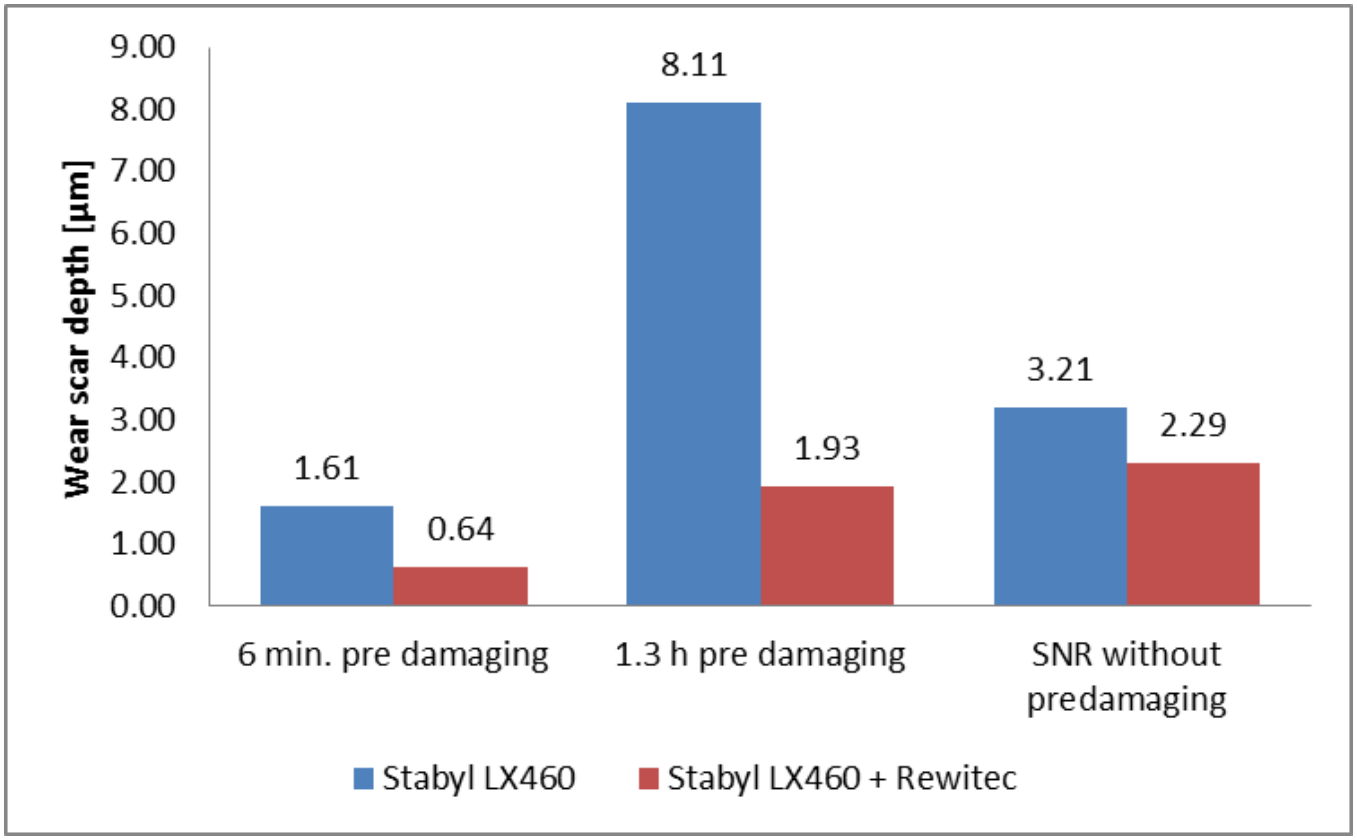


Right unit: **Rewitec**-modified

Compared to the test with pre-damaging the differences are not very big. It seems that the pre-damaging has nearly no influence. The modified grease seems to have fundamentally a better performance under small oscillating angles than the base grease.

Overview wear mark depth

All wear mark depths were measured with an white light interferometer.



The values are the avarage of at least 8 single marks.

I can be seen clearly, that the use of Rewitec reduces the wear mark depth.
Especially the runs with a pre damaging by standstill conditions show significant advantages for the Rewitec modified grease.

Conclusion

The tests show that adding Rewitec to a standard grease can provide benefits in case of standstill mark / false-brinelling damage. The wear mark depth in the case of pre damaged bearings can be reduced by the addition of Rewitec significantly.

The tests without pre-damaging show that the modification already improves the performance in the test with small oscillating angles (+/-3 °).

However, the results have just a small statistical certainty and are just valid for the tested grease under the chosen parameters.