

Science For A Better Life

UNECE – GRSG - IGPG

TF Wiper SG2 - final report

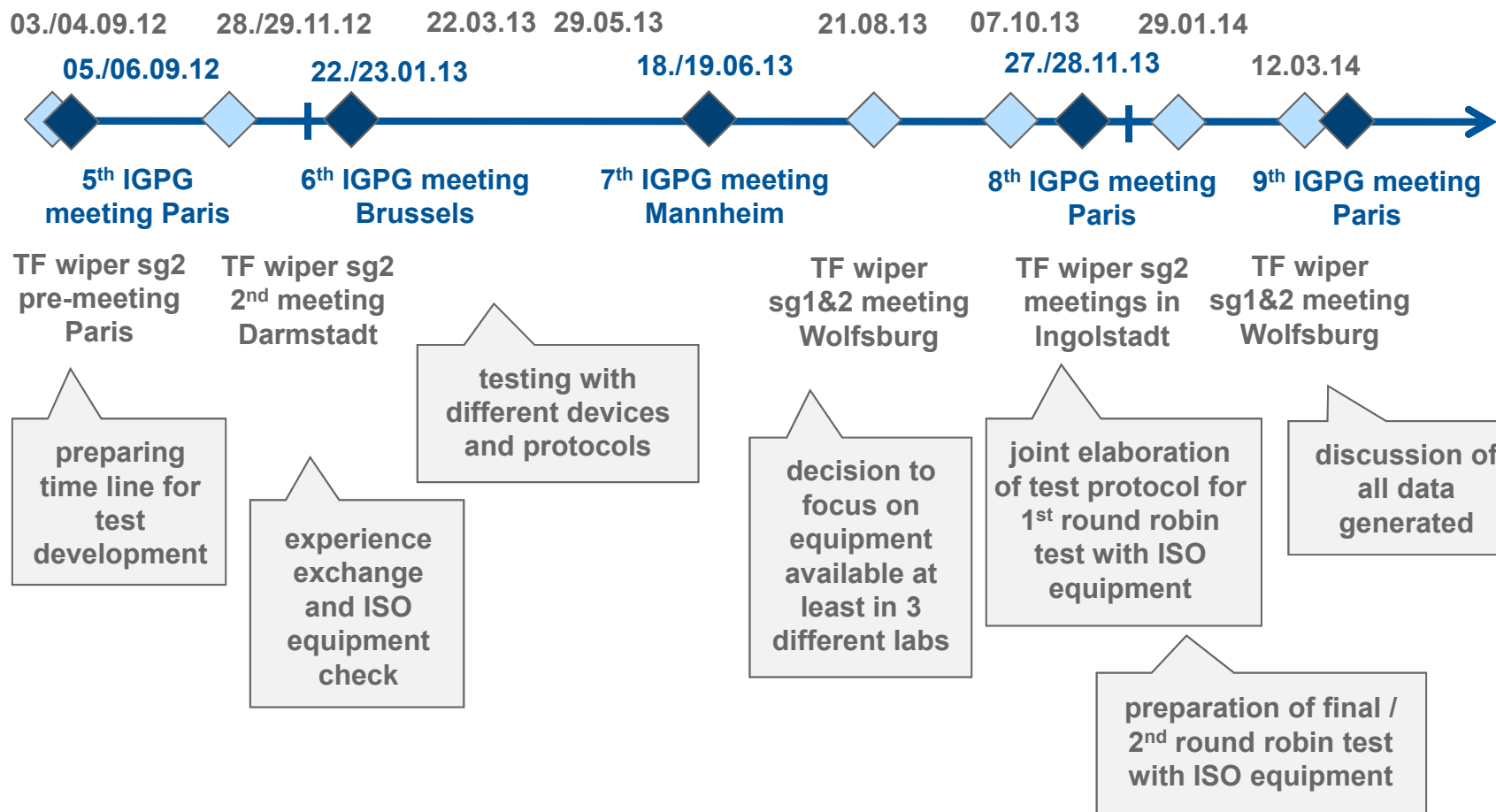
2014-03-25 Dr. Frank Buckel

Agenda



- history & time frame
- TF wiper sg2 lab / approval test (basic requirements & description)
- TF wiper sg2 round robin results (incl. table of equivalence)
- correlation of lab test with road or life time data (microscope images & haze values)
- summary of TF wiper sg2 work

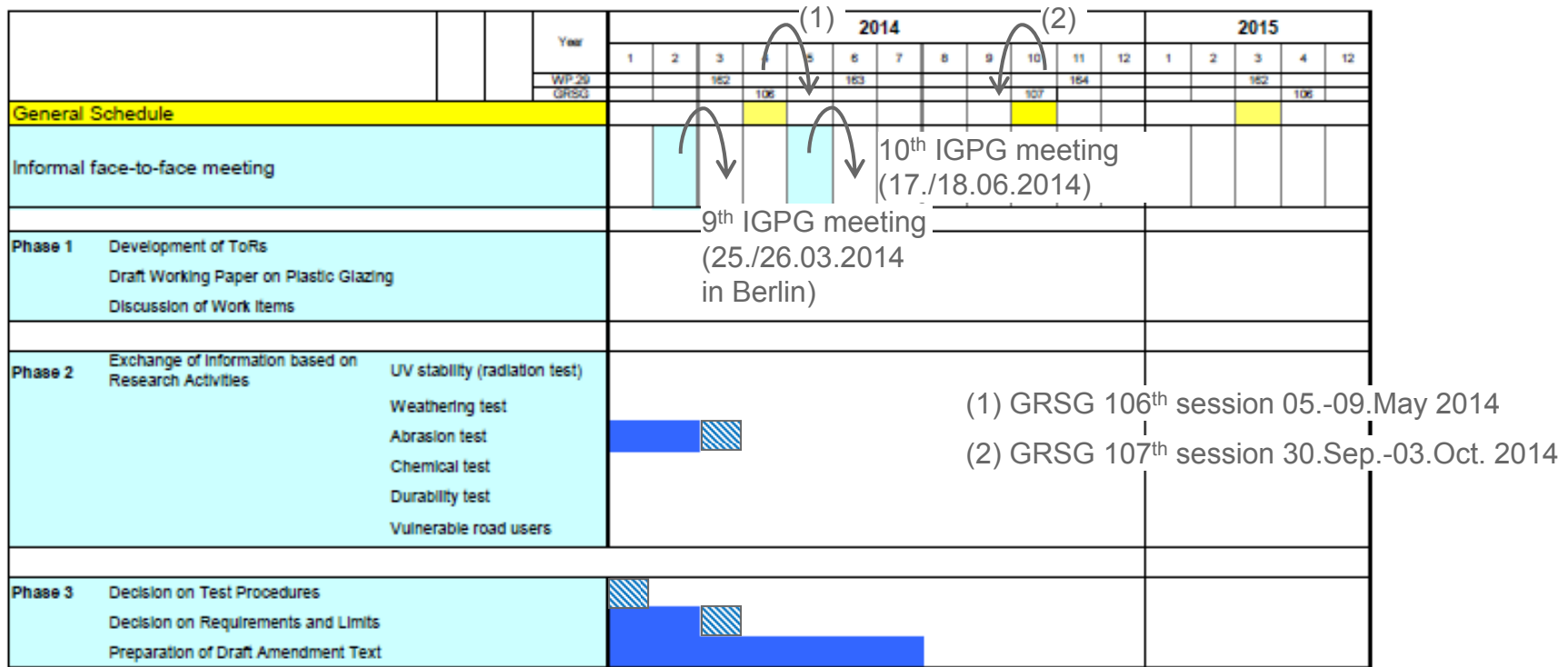
TF wiper history



TF time frame



Draft Schedule of Informal Group on Plastic Glazing



Source: GRSG-104-42e

- Decision on test procedure as well as requirements and limits this month

TF wiper sg2 lab / approval test



basic requirements for a approval test

➤ ensures the use of “safe” glazing types

- test procedure needs to be *realistic* in the kind and amount of “incidents” (in order to mimic real life)
- ... needs to be *reproducible* (all approval test houses yield similar results)
- the limit should *allow approval of suitable* and exclude unsuitable types within the range of reproducibility (to avoid differences between “initial” approval and conformity of production due to test accuracy)

HERE: get an additional reproducible and realistic test for wiper action as alternative (together with sand drop and car wash) to Taber abrasion method for testing plastic glazing

6. General requirements

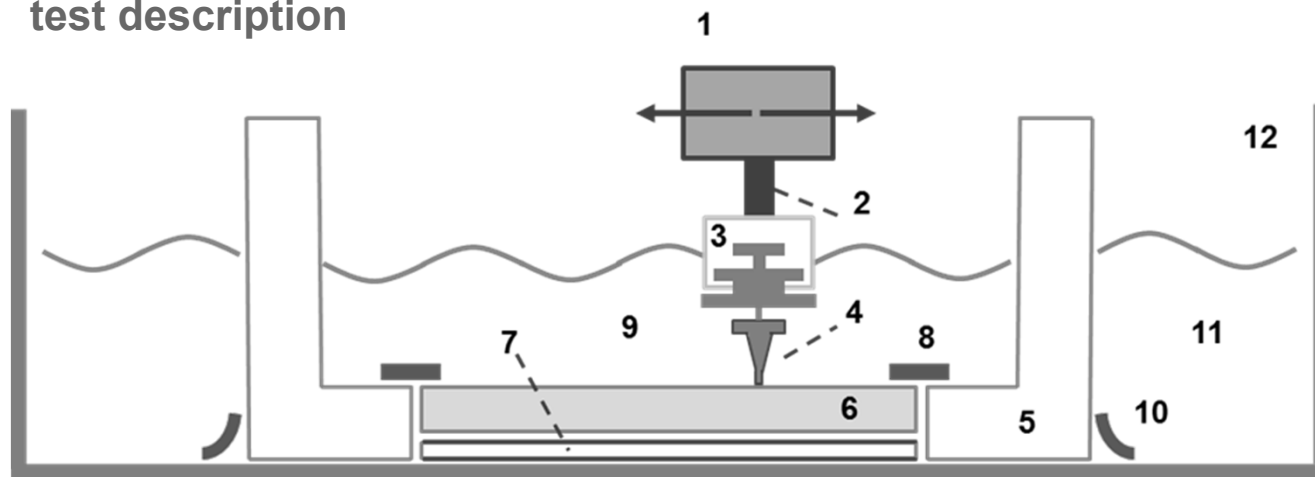
- 6.1. All glazing materials, including glazing material for the manufacture of windscreens, shall be such that, in the event of shattering, the danger of bodily injury is reduced as far as possible. The glazing material shall be sufficiently resistant to the incidents likely to occur in normal traffic, and to atmospheric and temperature conditions, chemical action, combustion and abrasion.

Source: ECE R43

TF wiper sg2 lab / approval test



test description



- 1 wiper carriage assembly moving back and forth
- 2 self-supporting arm
- 3 wiper blade holder
- 4 wiper blade
- 5 sample box working as test sample holder and as container for the aqueous suspension

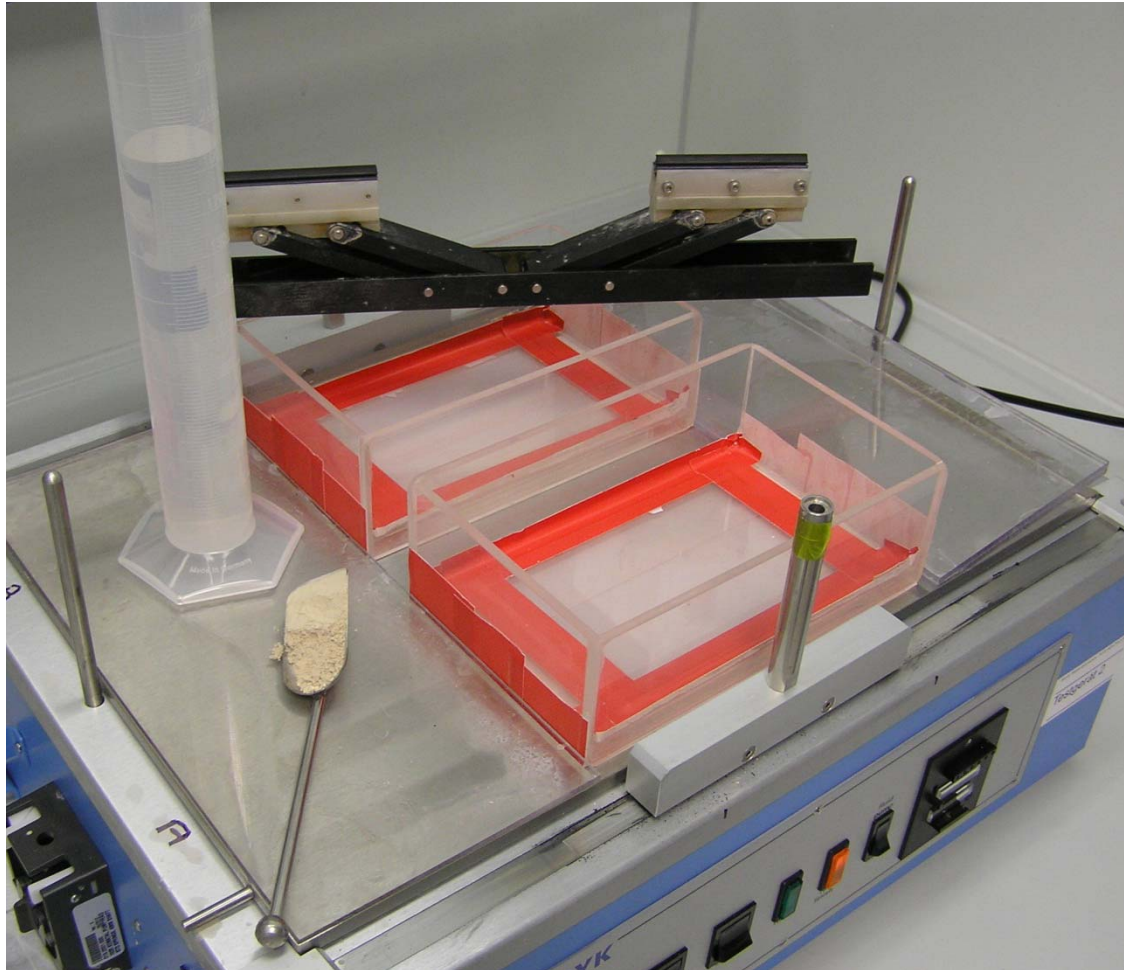
- 6 test sample
- 7 spacer plaque to adjust height of the sample to the level of the bottom surface of the sample box
- 8 adhesive tape to fix sample and to seal the gap between sample and its box
- 9 aqueous suspension filled into the box
- 10 adhesive aluminium tape to fix the sample box onto the stainless steel tray (11 water filled into the stainless steel tray ((avoids penetration of aqueous suspension underneath the test sample)))
- 12 stainless steel tray



Microsoft Word
Document

**detailed test
description used for
Feb 2014 round robin**

TF wiper sg2 lab / approval test



selected lab test parameter

equipment: scrub resistance tester (ISO 11998) with additional wiper blade holder and sample box

test sample: flat with a size of 150 x 100 mm

wiper blade: CR grade with special profile (Bosch H-Stoff P6.3)

stroke length: 130 ± 5 mm (half a wipe cycle)

wipe speed: 160 ± 15 mm/s (average)

wipe load: 15 g/cm

test mixture: 2,5% test dust (ISO 12103-1) A4 in water

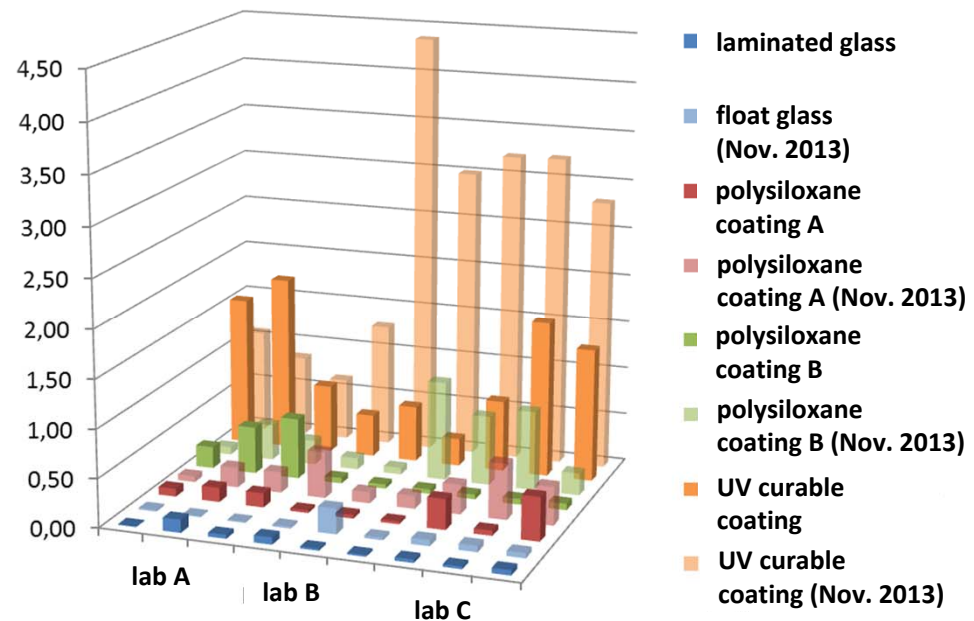
no. of wipe cycles: 10.000 / 20.000

TF wiper sg2 round robin results



- a **first round robin** took place in **Nov. 2013** (results after 5.000 and 10.000 wipe cycles already reported at the last IGPG meeting)
- further test improvements discussed in Ingolstadt (29.01.2014)
- second round robin in Feb. 2014
 - more homogeneous scratch distribution on single test samples (standard deviation of the measurement points per sample lower)
 - deviation within the three replicates per lab and sample type lower
 - reproducibility not improved (even slightly worse)

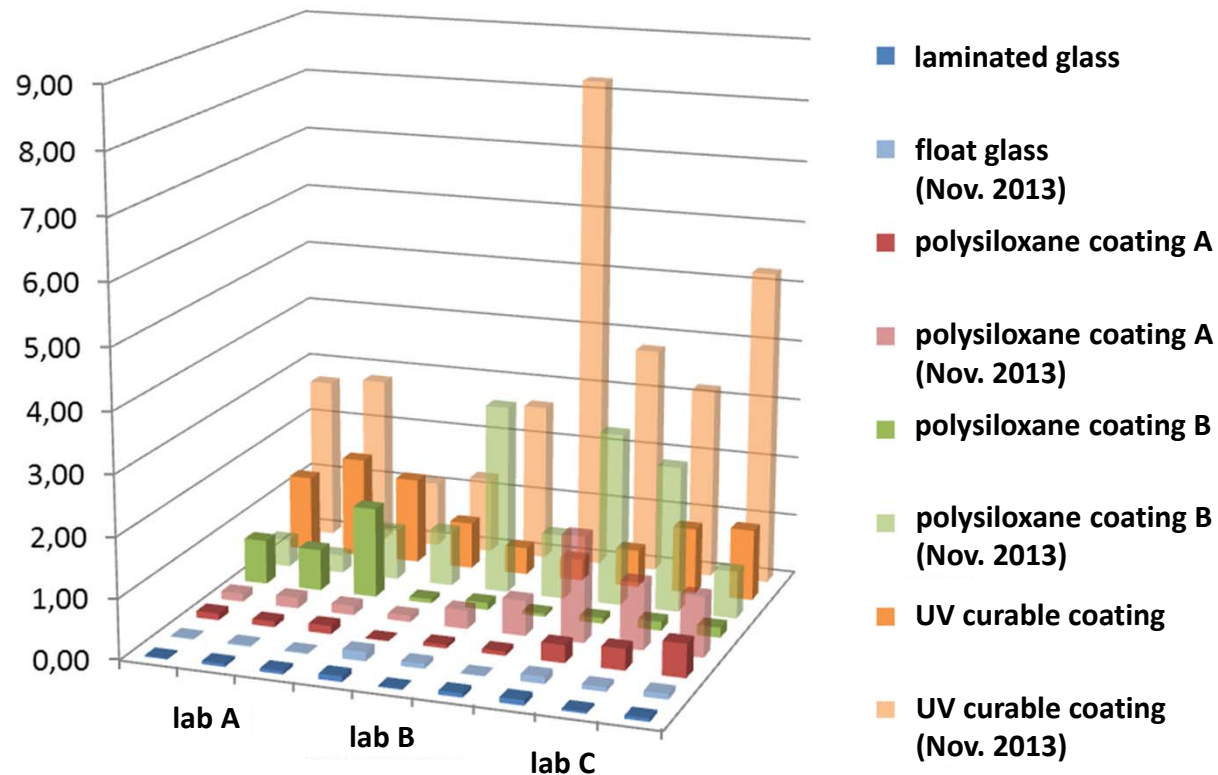
standard deviation of the haze measurement on individual samples (10.000 wipe cycles)



TF wiper sg2 round robin results



standard deviation of the haze measurement
on individual samples (20.000 wipe cycles)



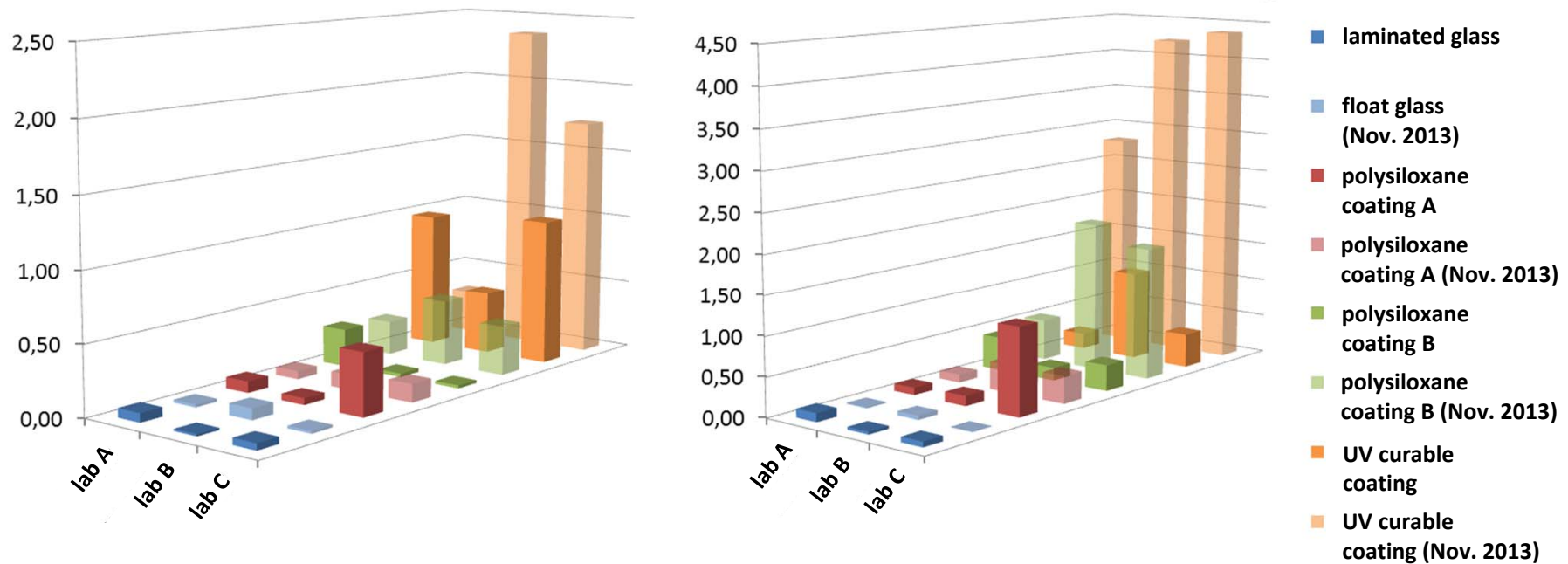
TF wiper sg2 round robin results



standard deviation of the average delta haze for the three replicates

10.000 wipe cycles

20.000 wipe cycles



TF wiper sg2 round robin results



wipe cycle no.	sample	average \bar{x}	standard deviation s_x	repeat-ability standard deviation s_r	reproduc-ibility standard deviation s_R	repeat-ability r	reproduc-ibility R
10.000	laminated glass	0,0659	0,0395	0,0478	0,0555	0,13	0,16
	polysiloxane A	0,2846	0,2633	0,2626	0,3396	0,74	0,95
	polysiloxane B	0,4491	0,6180	0,1573	0,6312	0,44	1,77
	UV curable	5,4128	4,9837	0,8660	5,0336	2,42	14,09
20.000	laminated glass	0,1338	0,0286	0,0783	0,0783	0,22	0,22
	polysiloxane A	0,7849	0,8271	0,6498	0,9826	1,82	2,75
	polysiloxane B	1,1662	1,2815	0,3277	1,3091	0,92	3,67
	UV curable	7,9357	4,4393	0,7172	4,4778	2,01	12,54

Feb 2014 round robin test

Nov. 2013 round robin test – 10.000

0,14	0,15
0,29	0,75
1,02	1,25
4,76	11,88

Nov. 2013 round robin test – 20.000

0,09	0,16
0,83	2,17
4,24	4,26
10,81	11,07

TF wiper sg2 round robin results



test method	glass		plastic with siloxane based wet coat		plastic with UV curable wet coat	
	Δ haze (%)	max Δ haze (P=95%) (%)	Δ haze (%)	max Δ haze (P=95%) (%)	Δ haze (%)	max Δ haze (P=95%) (%)
<i>Taber 1000 cyclen (IGPG)</i>	1,17	1,95	10,52	37,58	15,57	37,08
<i>Taber 1000 cyclen (ISO 2012)</i>	0,73	1,18	4,19	7,99		
<i>Taber 1000 cyclen (ISO 2013)</i>			4,17	7,42		
<i>Sand drop (IGPG)</i>	3,38	4,78	3,06	4,39	5,01	8,04
<i>Amtec Kistler (IGPG)</i>	0,19	0,63	0,74	1,83	3,04	6,67
<i>wiper test (IGPG TF) 10.000 cycles</i>	0,07	0,18	0,28	0,96	5,41	15,48
			0,45	1,71		
<i>wiper test (IGPG TF) 20.000 cycles</i>	0,13	0,29	0,78	2,75	7,94	16,89
			1,17	3,78		



Correlation of lab test with road or life time data

How to correlate lab wiper test data with on road test or life time data?

- kind of abrasion action
 - comparison of microscope images

Plastic Windscreens

Comparison of Microscopic Images with Abrasion Tests



plastic windscreens from KRD (IGPG-04-02)

- mileage: 136452 km
- haze values: 1,3-1,6% (driver field of vision) and 0,9-1,0% (front-seat passenger side)

abrasion tests on samples from KRD (same coating)

wiper test - 1000 wipe cycles	Taber - 1000 cycles	car wash test	sand drop test

driver field of vision (amplification 30x) front-seat passenger side (amplification 30x)

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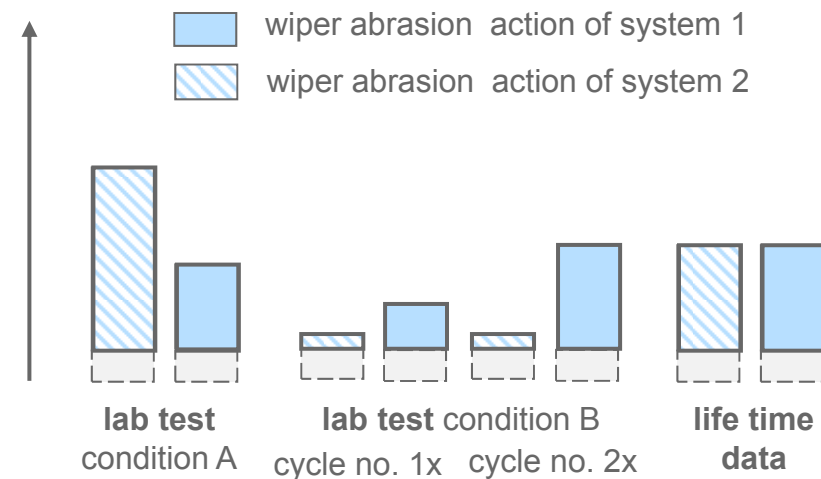
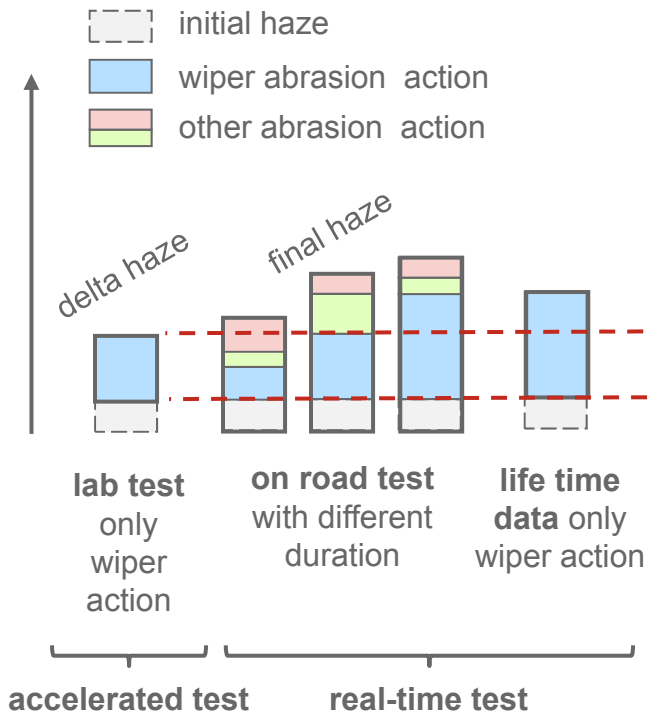
Bayer MaterialScience

Source: IGPG-05-04e



Correlation of lab test with road or life time data

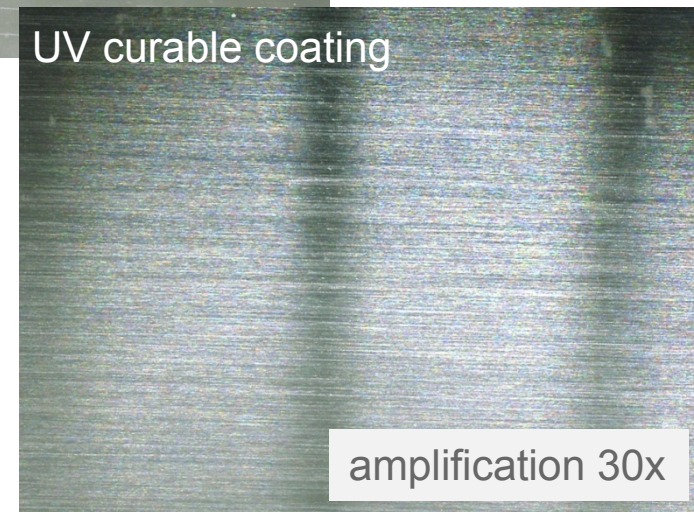
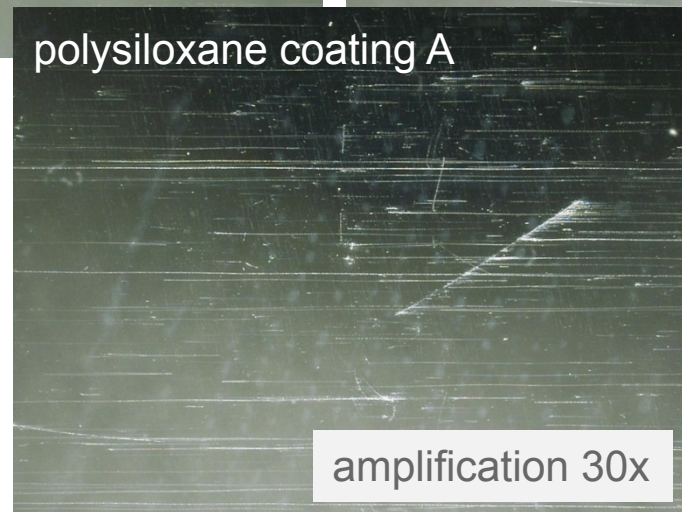
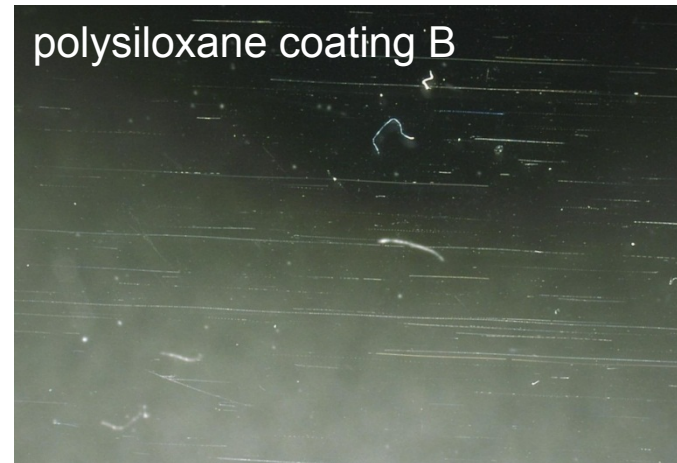
- degree of abrasion action
 - comparison of values acc. to following schema



Do all system have the same correlation factor (or do the conditions show different severity for different systems)?

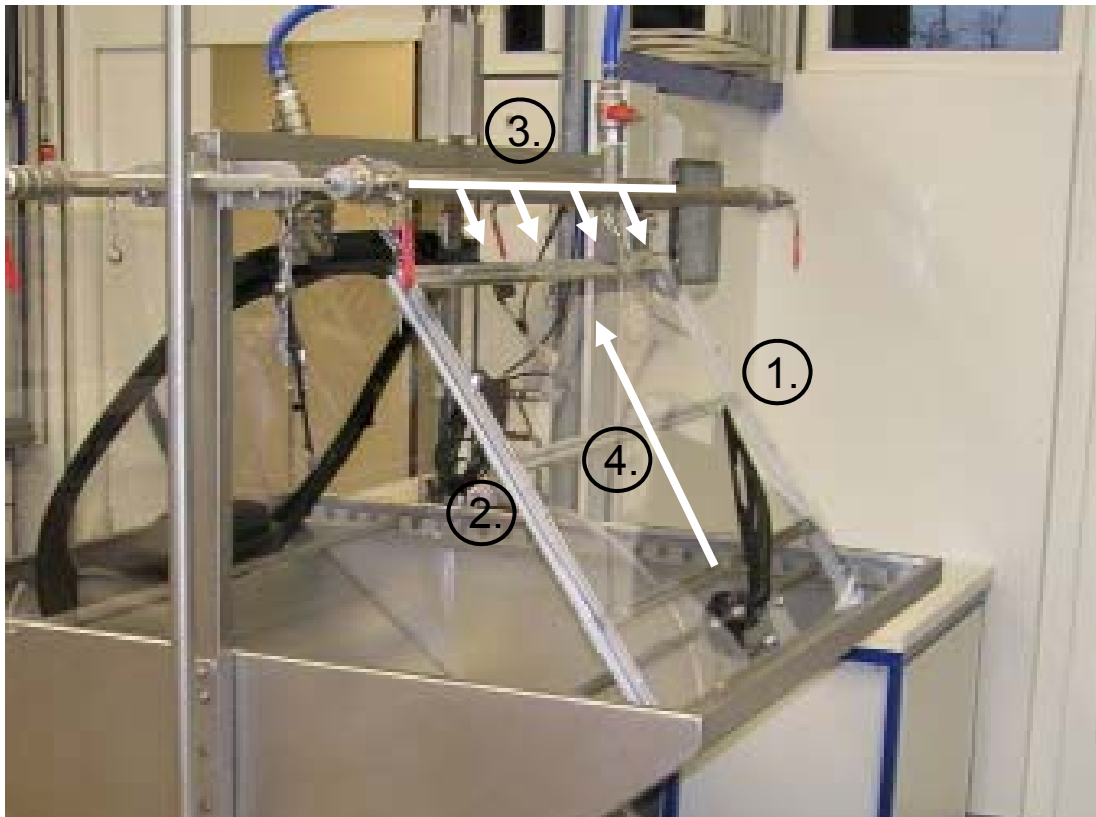


Microscope Images after 20.000 cycles wiper abrasion in the lab test



BMS experimental data

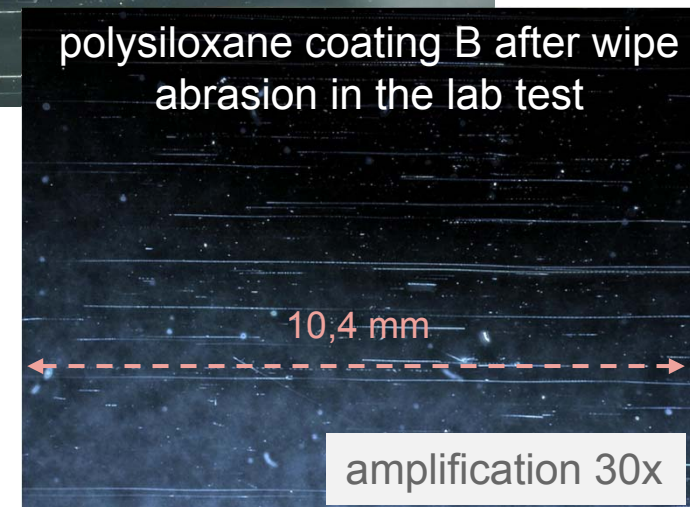
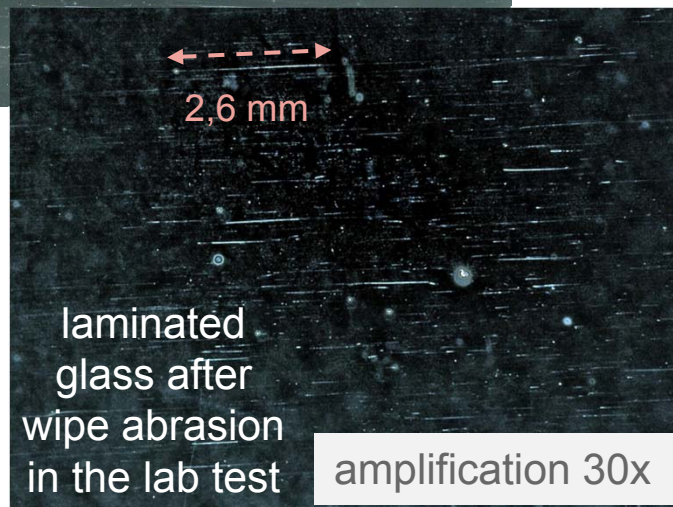
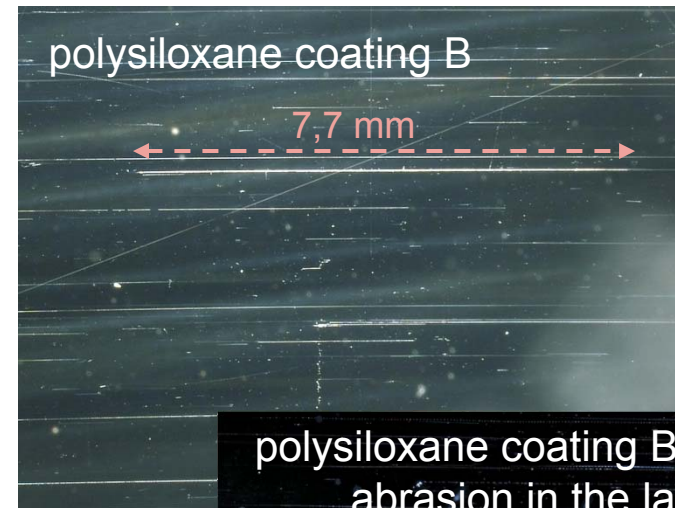
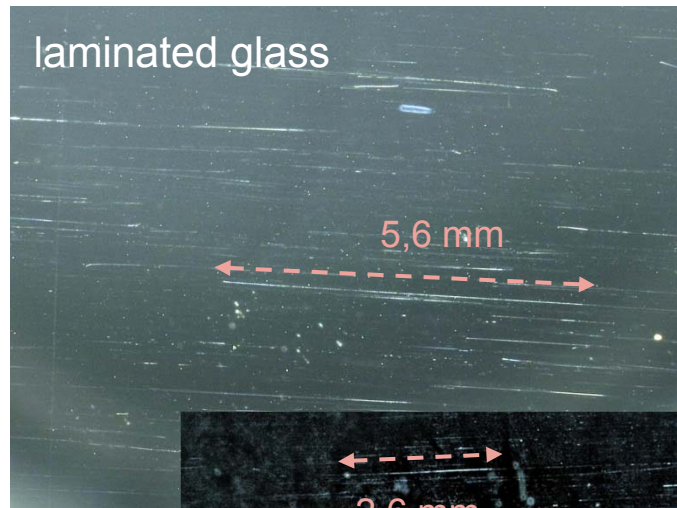
using an existing rear window wiper



- ① rear window wiper system (semi-circular movement; 35 cycles (back and forth) per min)
- ② fixed substrate (45° to normal)
- ③ water / slurry supply (pump delivery rate 5 l/s)
- ④ different wipe speeds across the substrate

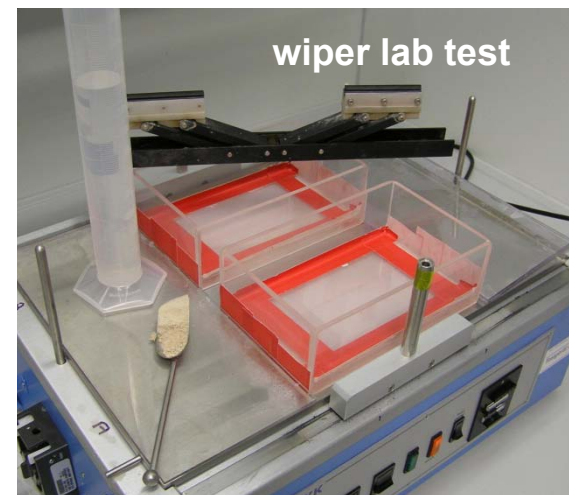
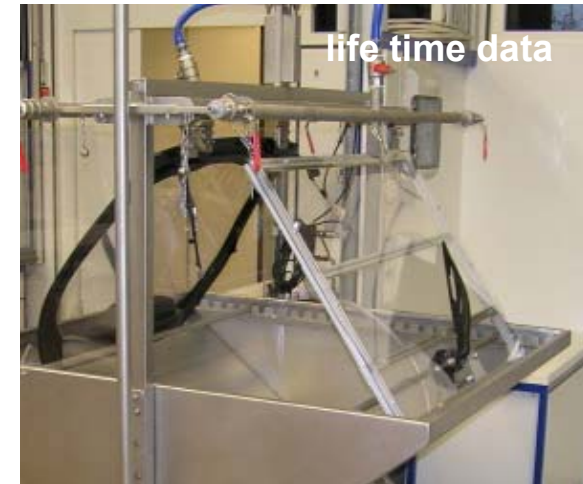
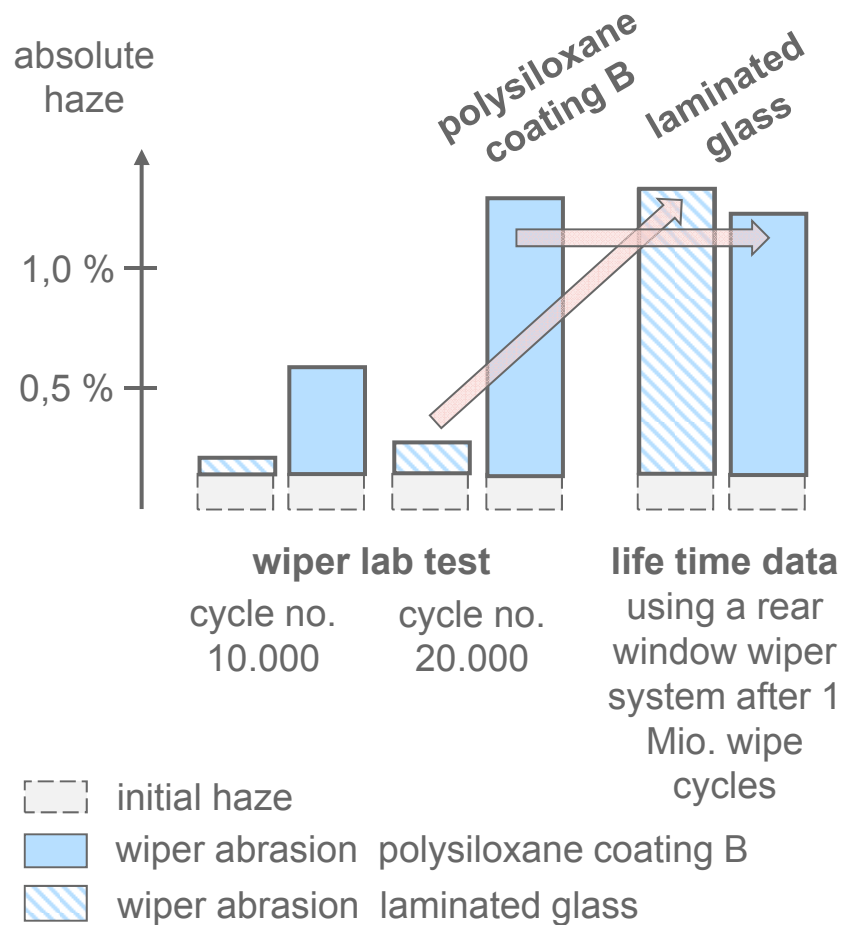


Microscope Images after 1.100.000 wipe cycles with a rear window wiper





Comparison of life time data with lab test for glass and polysiloxane coating B

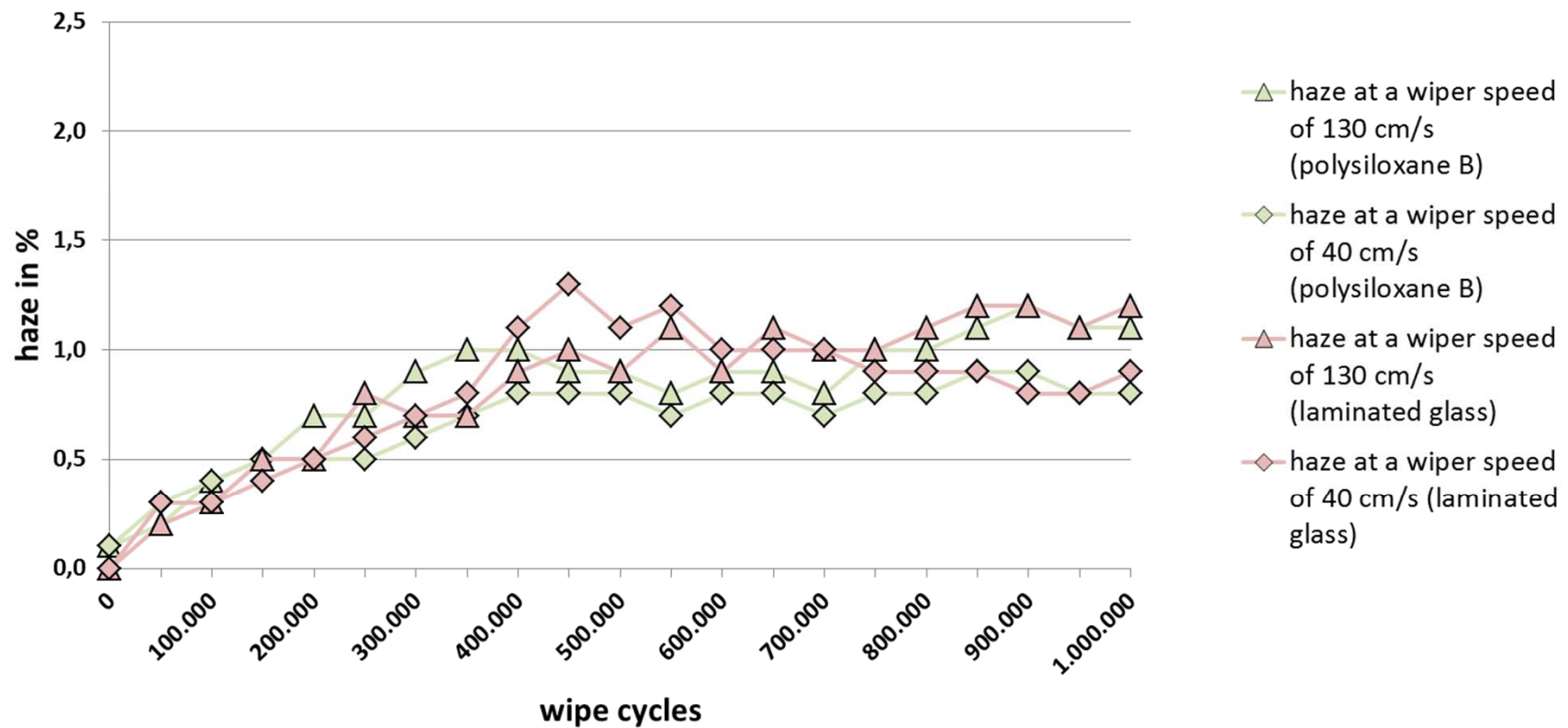




BMS experimental data

using an existing rear window wiper

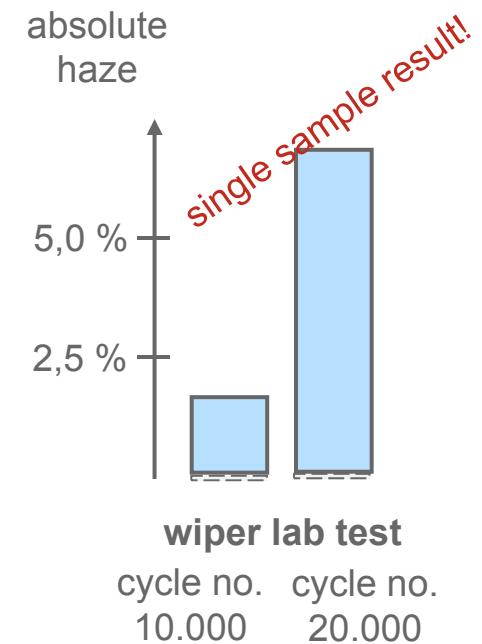
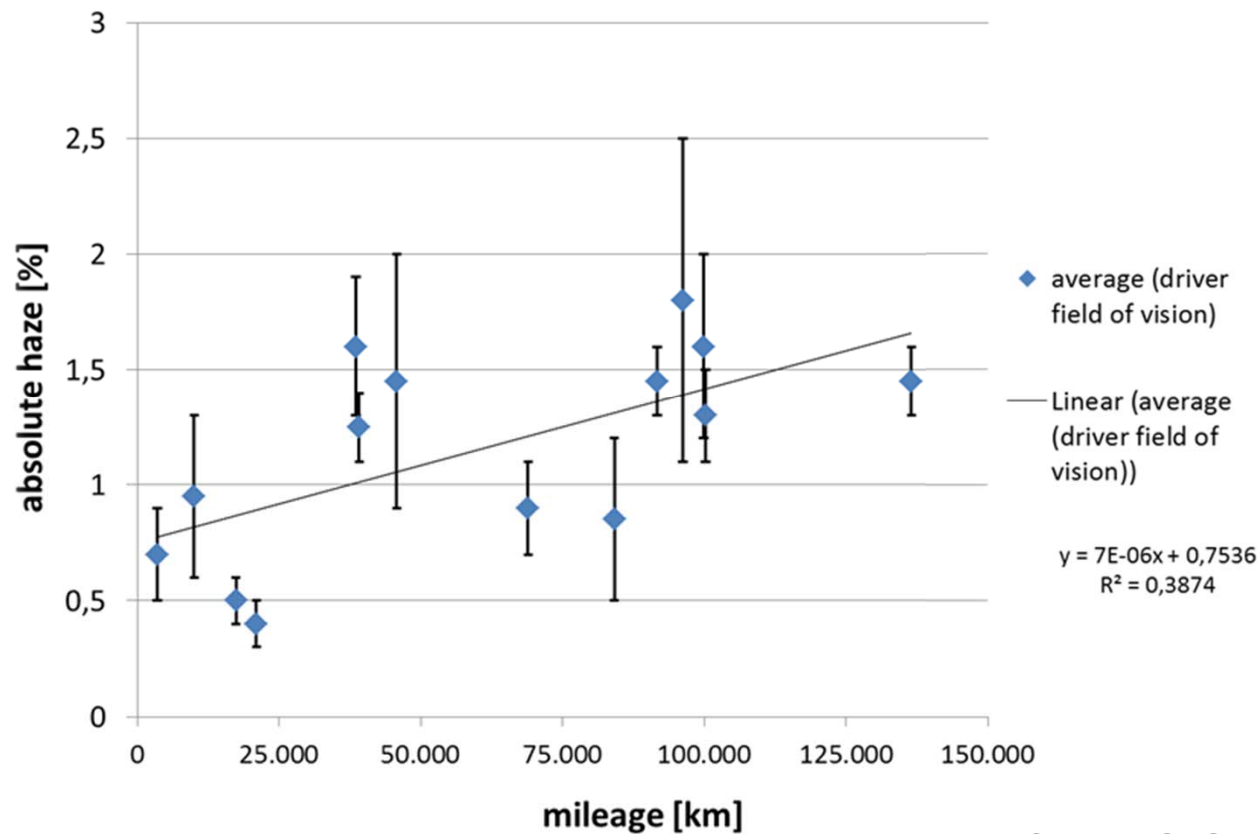
haze vs. wipe cycles for a rear window wiper (polysiloxane B vs. laminated glass)





Comparison of police car windscreens with lab test results

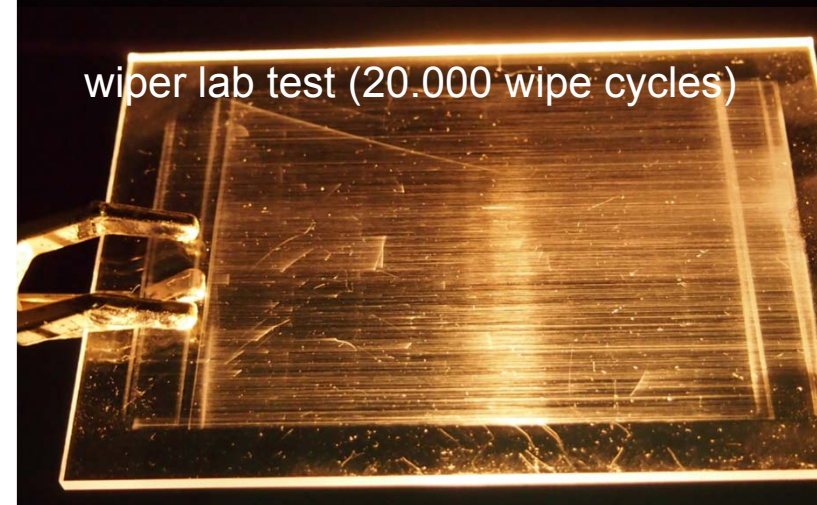
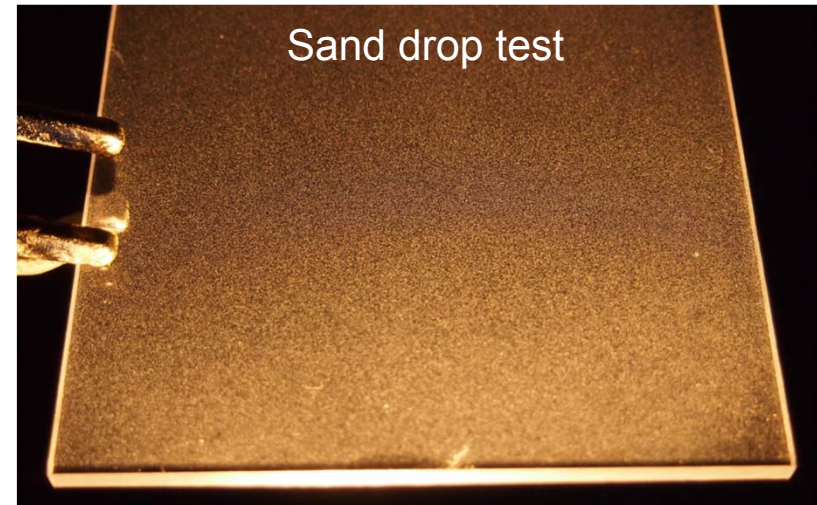
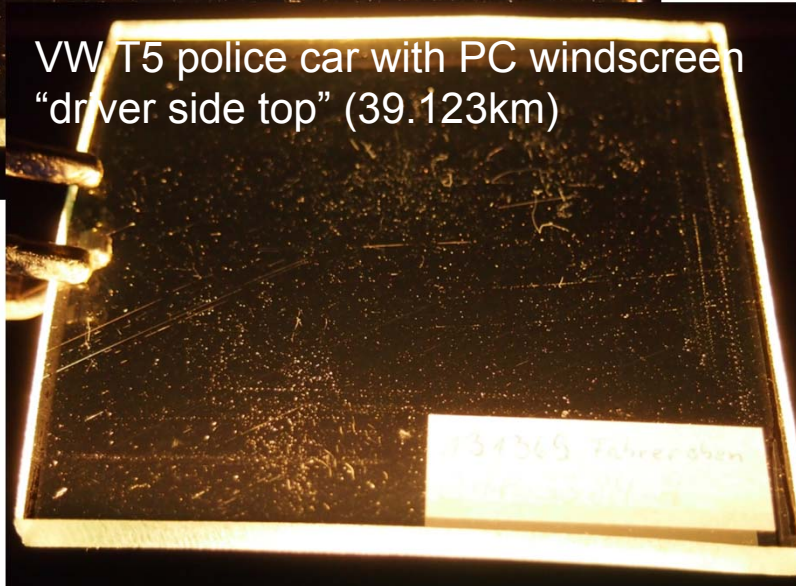
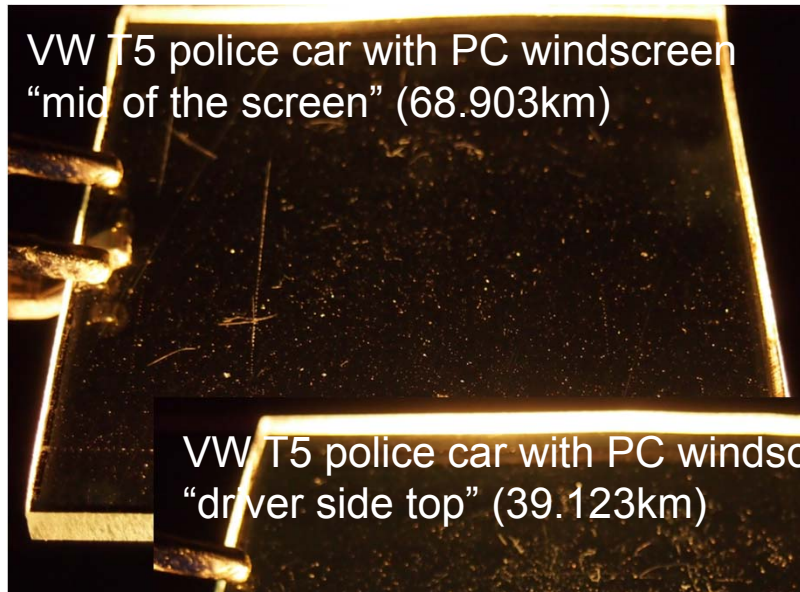
haze values of plastic windscreens vs. mileage



Source: IGPG-05-04e

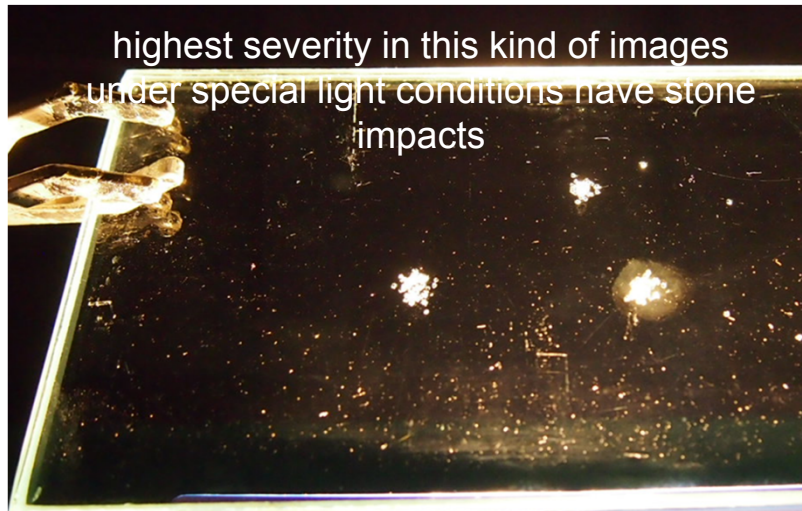


Comparison of images under special light conditions





Comparison of images under special light conditions





Summary of TF wiper sg2 work

- lab wiper abrasion test was developed which is
 - **realistic** (similar abrasion kind)
 - shows **good reproducibility** for 10.000 wipe cycle (slightly worse for 20.000 wipe cycle)
 - allows to clearly differentiate between different coating systems (UV curable or different polysiloxane ones) after short test time

➤ **task of sg 2 is fulfilled**

further gathered information:

- the conditions selected are more severe for the hydrophobic coatings (water contact angle approximately 90°) compared to glass due to the use of wiper blades optimized for glass (hydrophilic nature) and wiping action under water
 - **longer scratches** (leading to higher haze values)
 - **chatter marks can appear**
- different correlation factor for hydrophilic and hydrophobic surfaces
- haze values after 20.000 wipe cycles for the coatings are already higher than the values gained after 52.000 wipe cycles in the on-road test (including sand impact)



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Thank you!

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