

IGPG: Task Force ‚Wipertest‘ – On-road tests (Subgroup 1)

Investigation of windshields with standard laminated glass

Questions:

Deterioration of windshields on road

Which kind of deterioration?

Can we measure the deterioration?

Is the damage of the windshield dangerous for the safety of traffic?

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Investigation of windshields with standard laminated glass

Which kind of deterioration?

Impacts

e.g. by stones, sand

mostly

Deterioration by wiper

e.g. scratches, reversal points

only at old windshields

Scratches,

e.g. by ice scratcher

only at old windshields



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Investigation of windshields with standard laminated glass

Windshields for investigations and measurements:

Mercedes E-class: safeguarding car - 55300 km

Mercedes E-class: safeguarding car - 164500 km

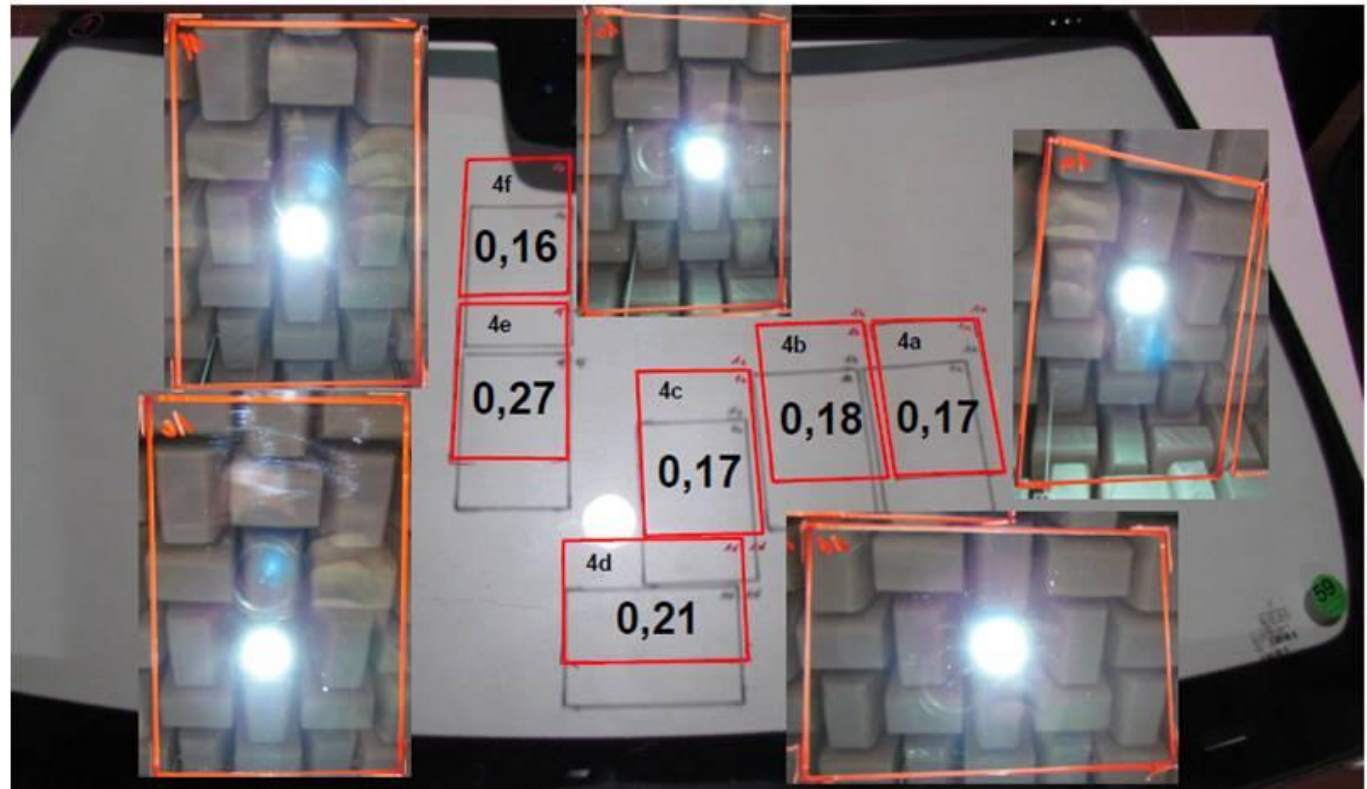
AUDI A6: pool car – 325100 km

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On-road tests: windshield in laminated glass - safeguarding Daimler E-Klasse

Red Marked Areas on the windshield with visible deterioration, measured Haze-values

- ▶ duration:
approx. 4 month
- ▶ mileage:
approx. 55300 km
- ▶ wiper cycles:
not much
not counted
- ▶ Haze values:
average 0,19 %



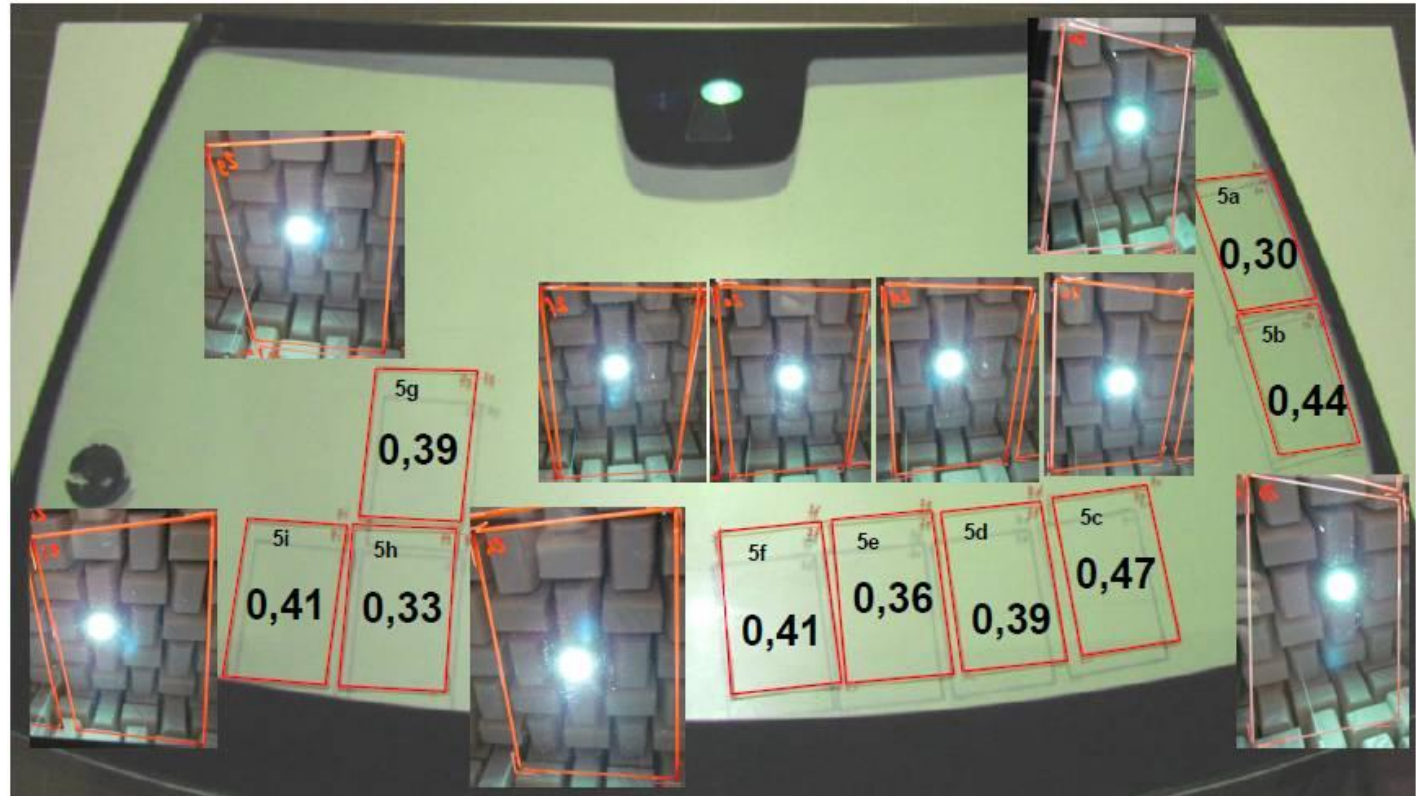
Only impacts

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On-road tests: windshield in laminated glass - safeguarding Daimler E-Klasse

Red Marked Areas on the windshield with visible deterioration, measured Haze-values

- ▶ duration:
approx. 12 month
- ▶ mileage:
approx. 164500 km
- ▶ wiper cycles:
some
not counted
- ▶ Haze values:
average 0,4 %



Dauerlaufwindschutzscheibe
Mercedes E-Klasse
164.514 km Raff-DL

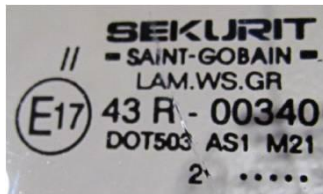
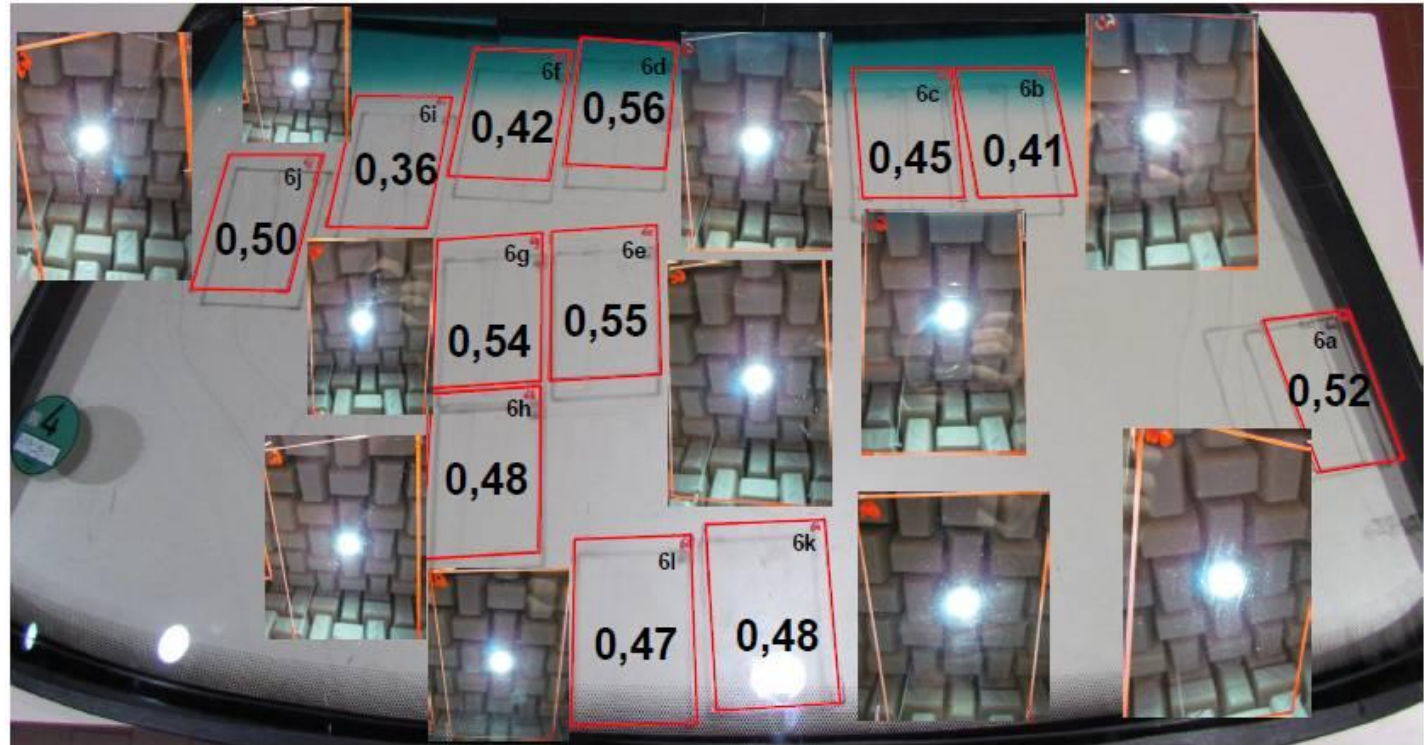
Only impacts

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On-road tests: windshield in laminated glass - poolcar AUDI A6 (Fa. Volke)

Red Marked Areas on the windshield with visible deterioration, measured Haze-values

- ▶ duration:
approx. 22 years
- ▶ mileage:
approx. 325100 km
- ▶ wiper cycles:
enough
not counted
- ▶ Haze values:
average 0,48 %



Mostly impacts, also wiper deterioration, scratches

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Investigation of coated PC-windshields

Windshields for investigations and measurements:

**BMW 3er: safeguarding car – approx. 30000 km
– approx. 2 month**

**Golf (1): pool car – approx. 10000 km
– approx. 3 month**

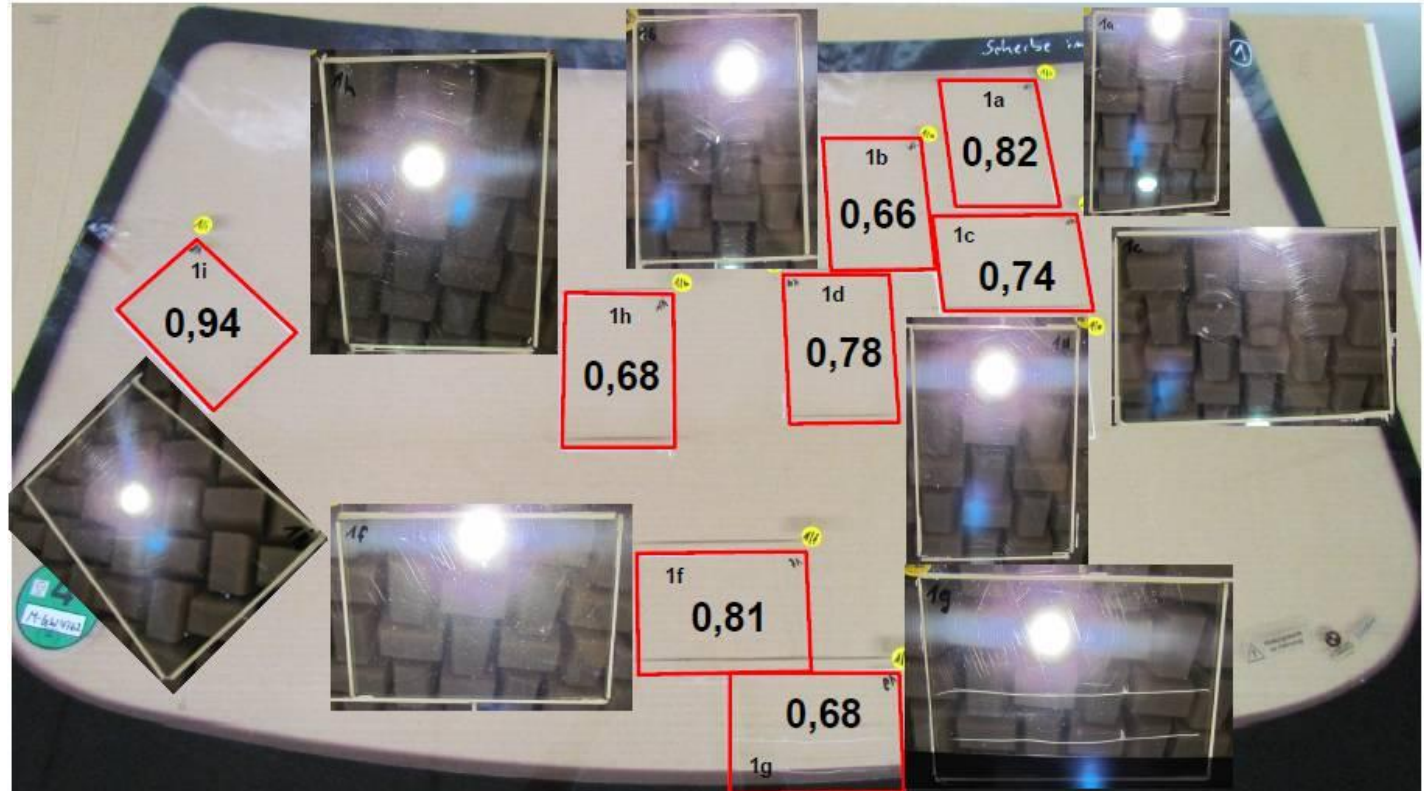
**Golf (2): pool car – approx. 8200 km
– approx. 9 month**

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On-road tests PC windshields with AS4700: safeguarding BMW 3er

Red Marked Areas on the windshield with visible deterioration, measured Haze-values

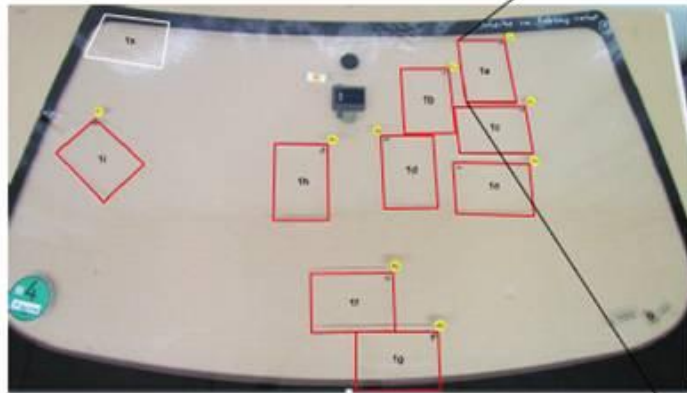
- ▶ duration:
approx. 2 month
- ▶ mileage:
approx. 30000 km
- ▶ wiper cycles:
not much
no counter
- ▶ Haze values:
average 0,76 %



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On-road tests PC windshields with AS4700: safeguarding BMW 3er

Deterioration of sample 1a:
double wiped area

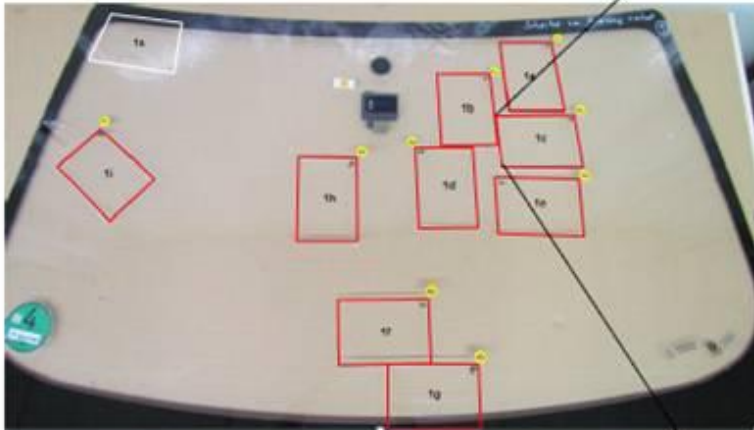


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On-road tests PC windshields with AS4700: safeguarding BMW 3er

Deterioration of sample 1c:

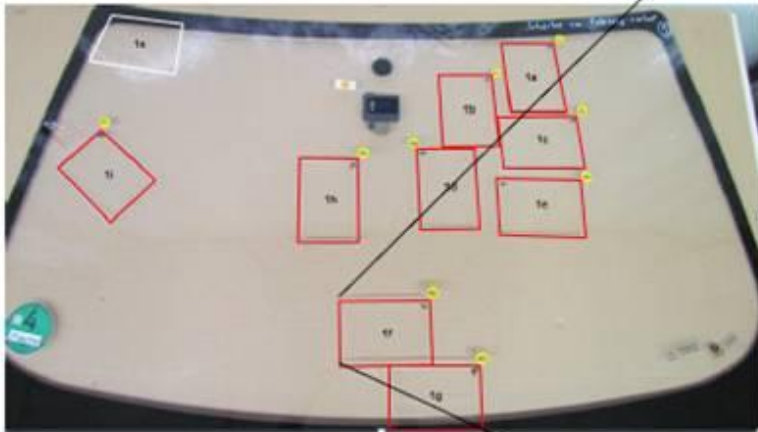
- by wiper
- stone impacts visible



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On-road tests PC windshields with AS4700: safeguarding BMW 3er

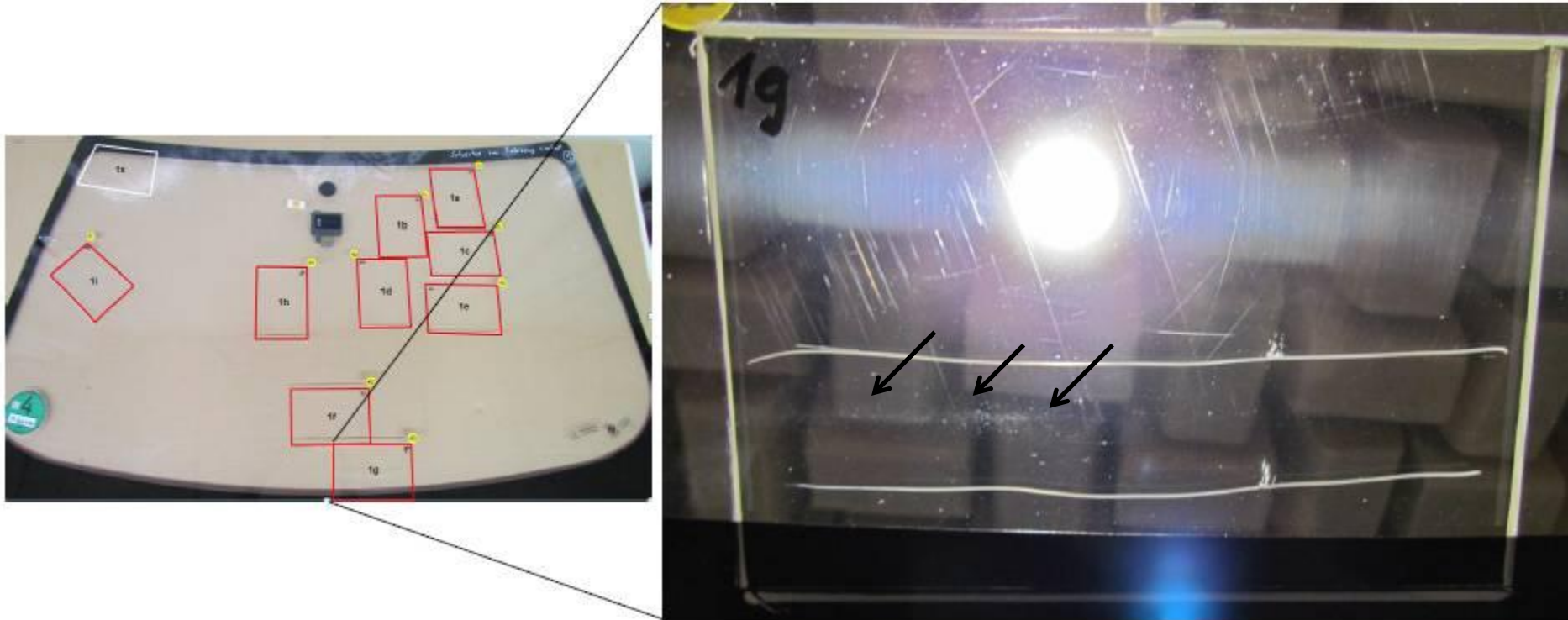
Detrioration of sample 1f:
mostly by stone impacts



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On-road tests PC windshields with AS4700: safeguarding BMW 3er

Detrioration of sample 1f:
mostly by stone impacts

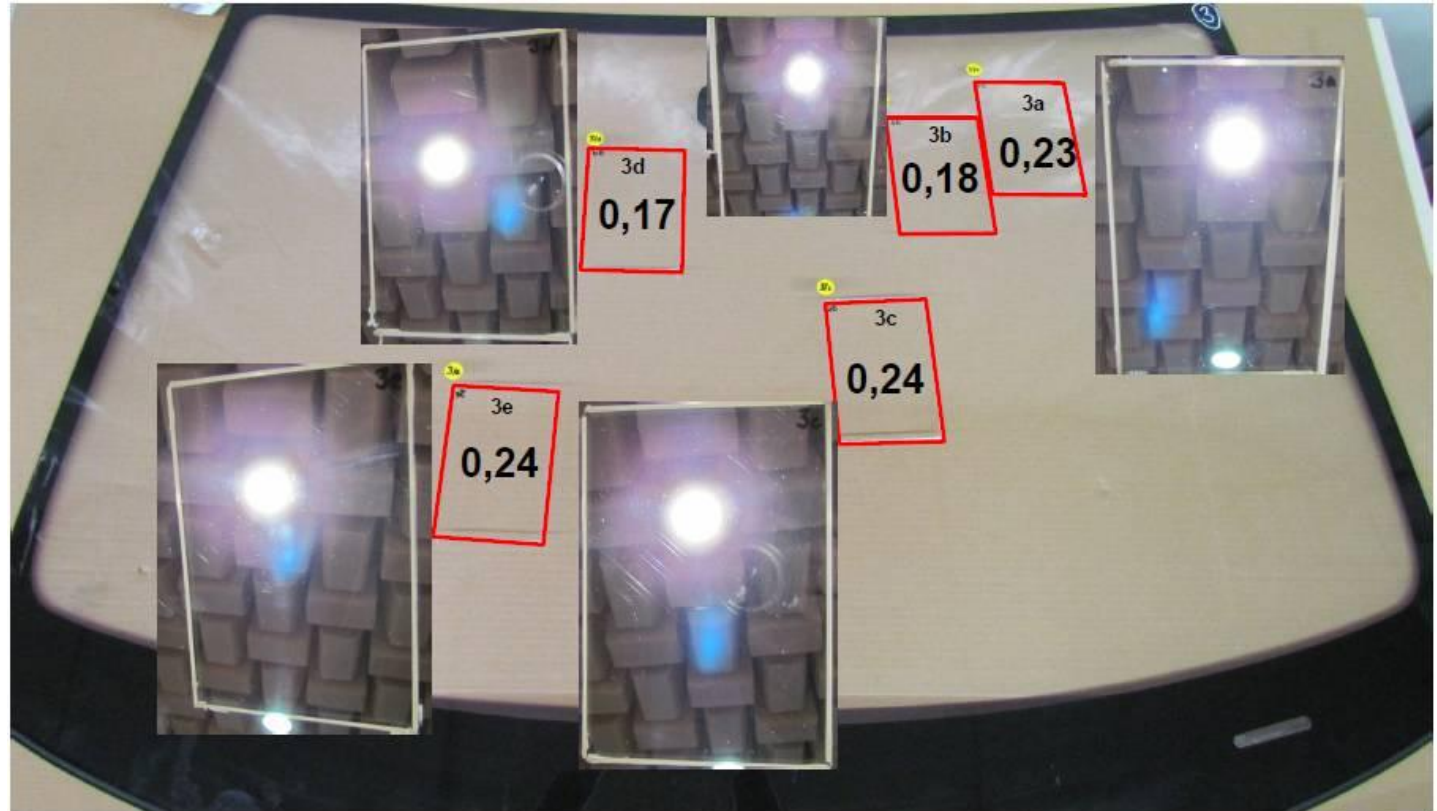


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On-road tests PC windshields with AS4700: test car Golf 6 1# (pool car EKKA)

Red Marked Areas on the windshield with visible deterioration, measured Haze-values

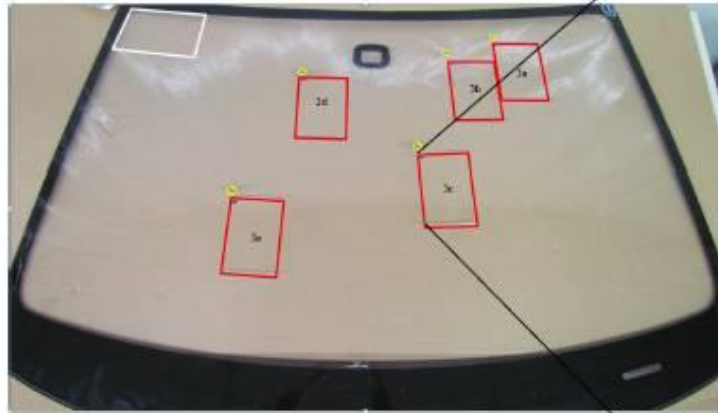
- ▶ duration:
approx. 3 month
- ▶ mileage:
approx. 10000 km
- ▶ wiper cycles:
52000
- ▶ Haze values:
average 0,21 %



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On-road tests PC windshields with AS4700: test car Golf 6

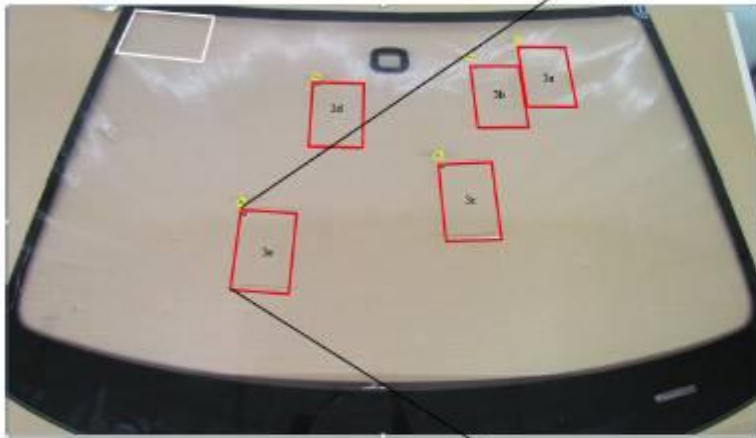
Deterioration of sample 3c:
by wiper



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On-road tests PC windshields with AS4700: test car Golf 6

Detrioration of sample 3e:
mostly by stone impacts

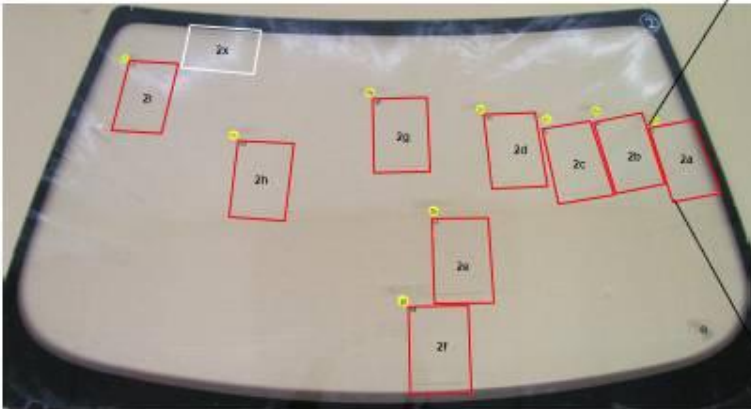


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Current on-road tests: PC windshields in test cars

Windshield: PC with AS4700

- ▶ BMW 3er
- ▶ wiper approval equipment
- ▶ 1,5 Mio cycles (without sand):
no visible deterioration
- ▶ 100 cycles with sand
manual distribution on the windshield

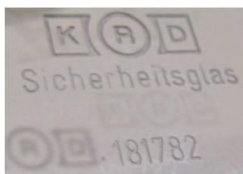
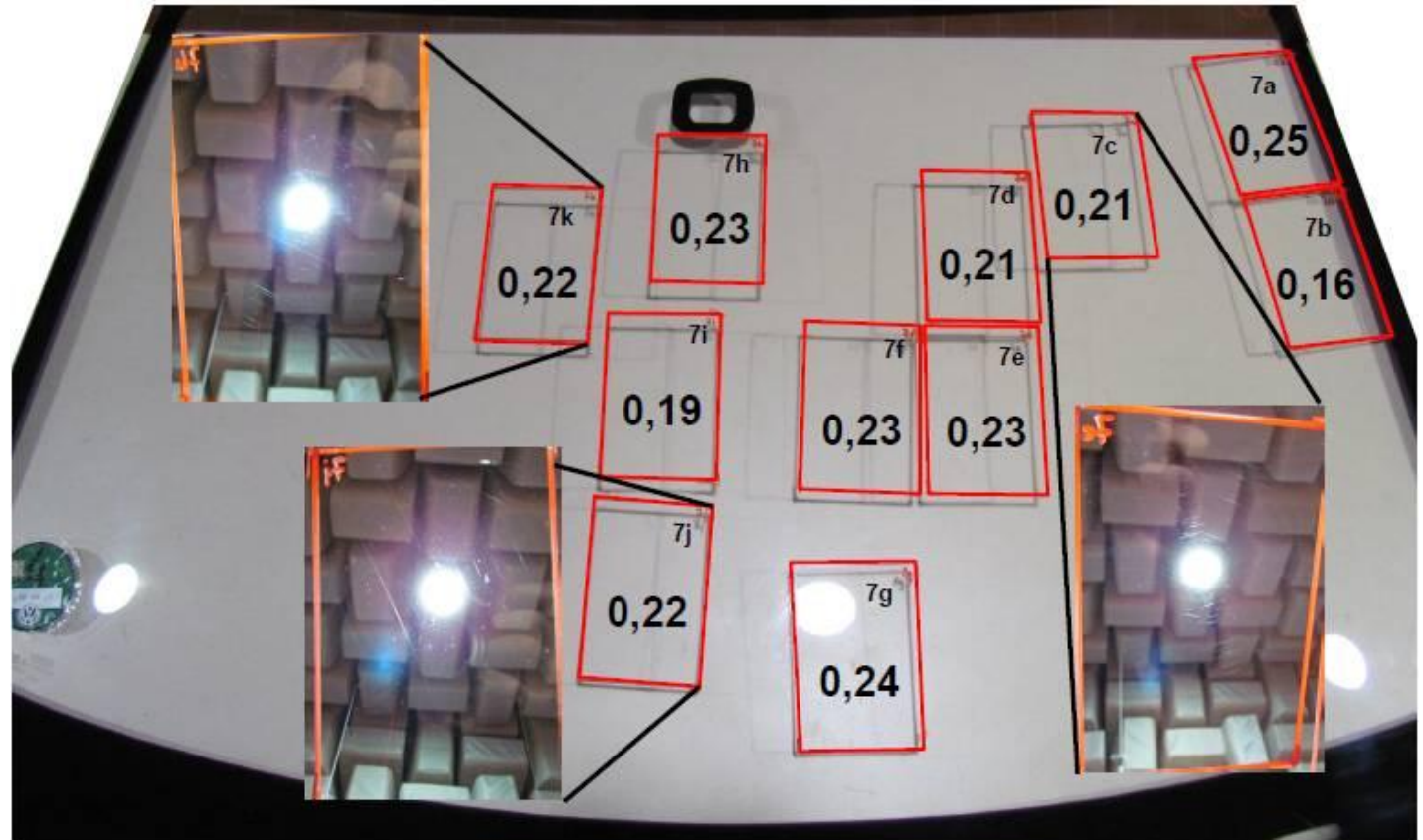


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On-road tests PC windshields with AS4700: test car Golf 6 2# (pool car EGMN/O)

Red Marked Areas on the windshield with visible deterioration, measured Haze-values

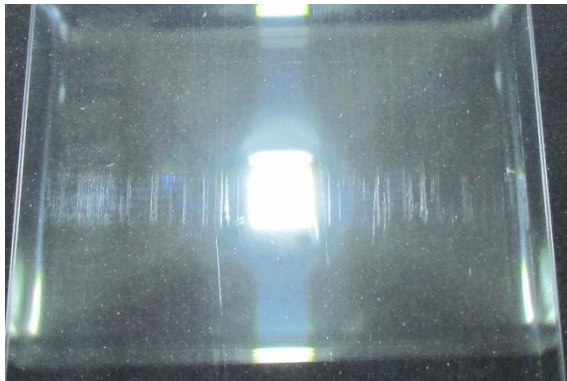
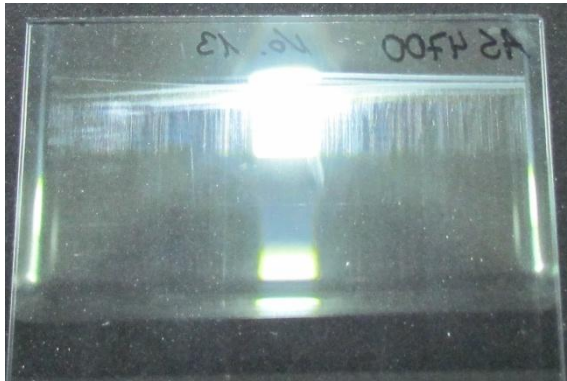
- ▶ duration:
approx. 9 month
- ▶ mileage:
approx. 8200 km
- ▶ wiper cycles:
3021
- ▶ Haze values:
average 0,21 %



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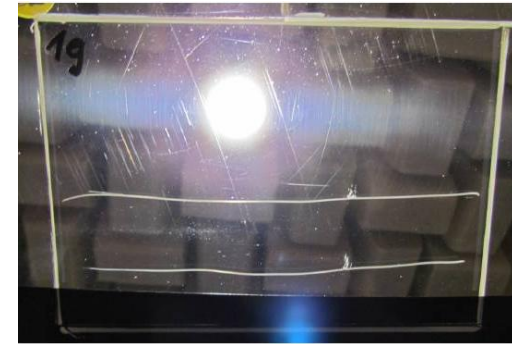
Comparison wiper test and on-road test: similar deterioration

Samples from wiper test

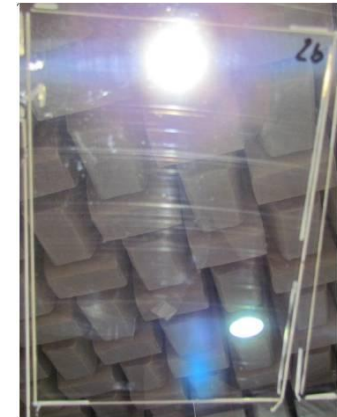


AS4700: 10000 cycles

Samples of the windshield from on-road test



Samples of the windshield from wiper test

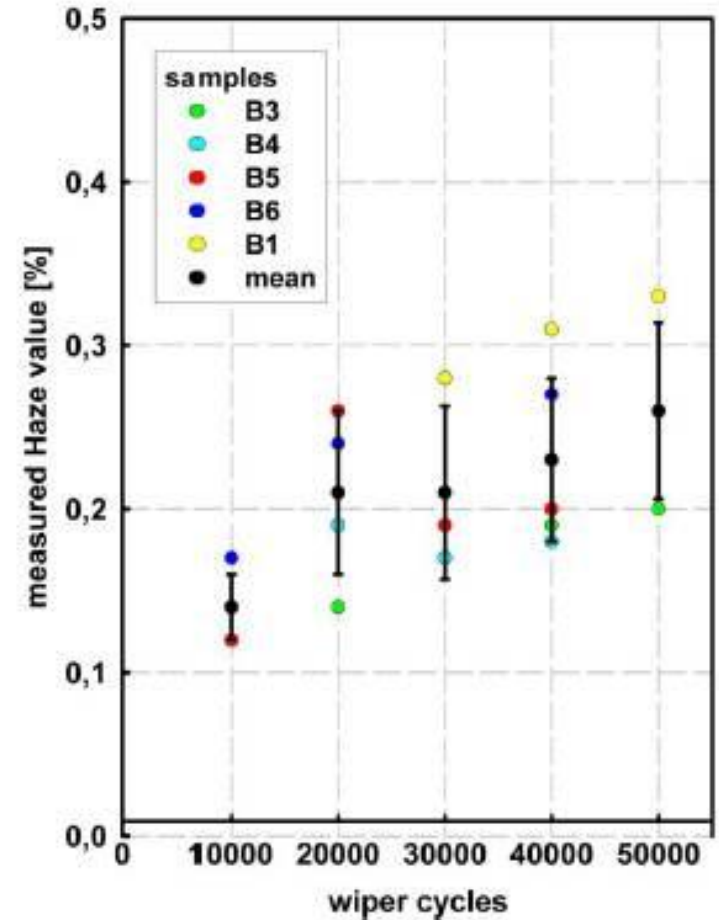


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Results wiper test: Haze values of different materials after wiper cycles

Laminated glass (VSG)

cycles	measured Haze [%]							
	samples						mean	standard deviation
	B3	B4	B5	B6	B1	B2		
10000	0,12		0,12	0,17		0,14	0,02	
20000	0,14	0,19	0,26	0,24		0,21	0,05	
30000	0,17	0,17	0,19	0,28	0,28	0,15	0,053	
40000	0,19	0,18	0,2	0,27	0,31	0,24	0,05	
50000	0,2				0,33	0,24	0,054	

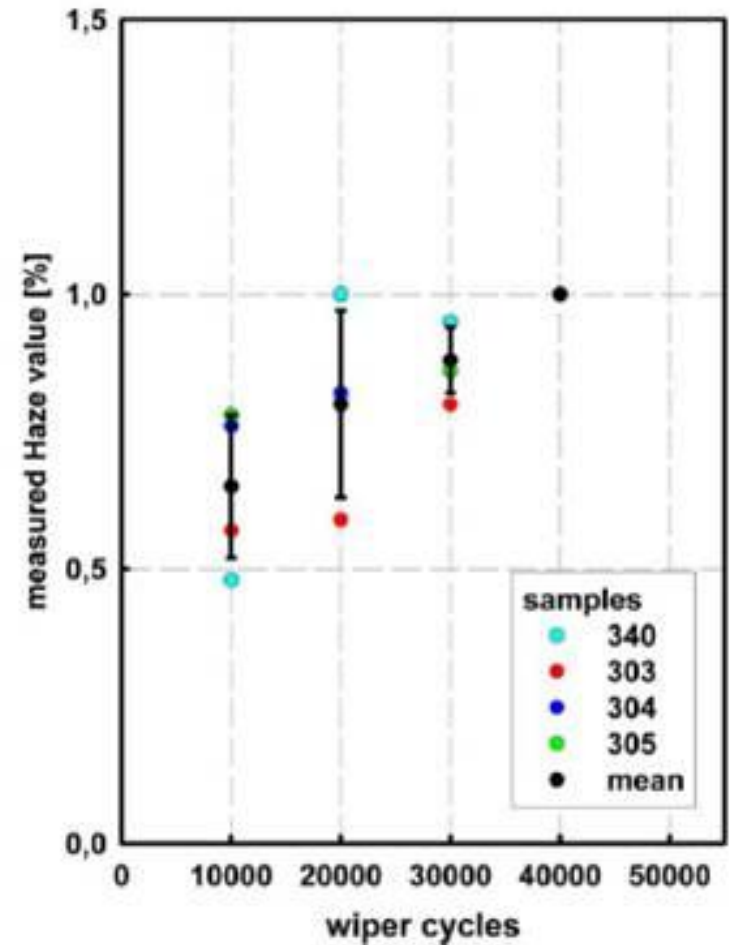


IGPG: Task Force ‚Wipertest‘ – Lab tests (Subgroup 2)

Results wiper test: Haze values of different materials after wiper cycles

PMMA coated

cycles	measured Haze [%]					
	samples				mean	standard deviation
	340	303	304	305		
10000	0,48	0,57	0,76	0,78	0,65	0,13
20000	1	0,59	0,82		0,8	0,17
30000	0,95	0,8		0,86	0,88	0,06
40000	1				1	
50000						

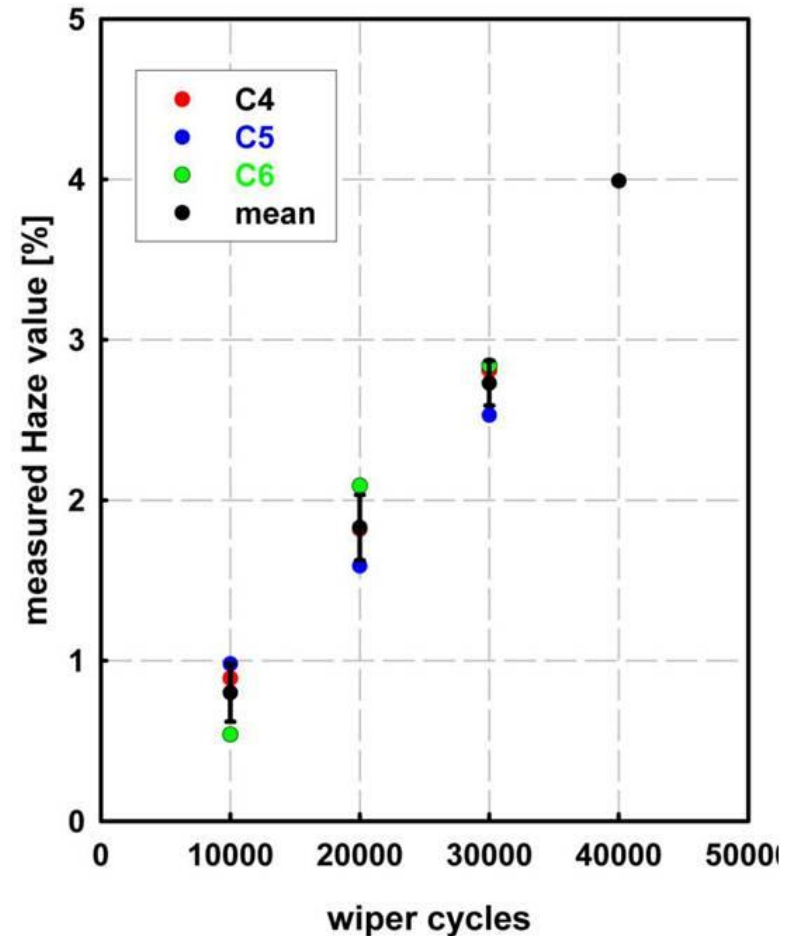


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Results wiper test: Haze values of different materials after wiper cycles

PC coated with AS4700

cycles	measured Haze [%]				
	samples			mean	standard deviation
	C4	C5	C6		
10000	0,89	0,98	0,54	0,8	0,18
20000	1,82	1,59	2,09	1,83	0,204
30000	2,81	2,53	2,84	2,73	0,14
40000		3,99		3,99	0
50000					

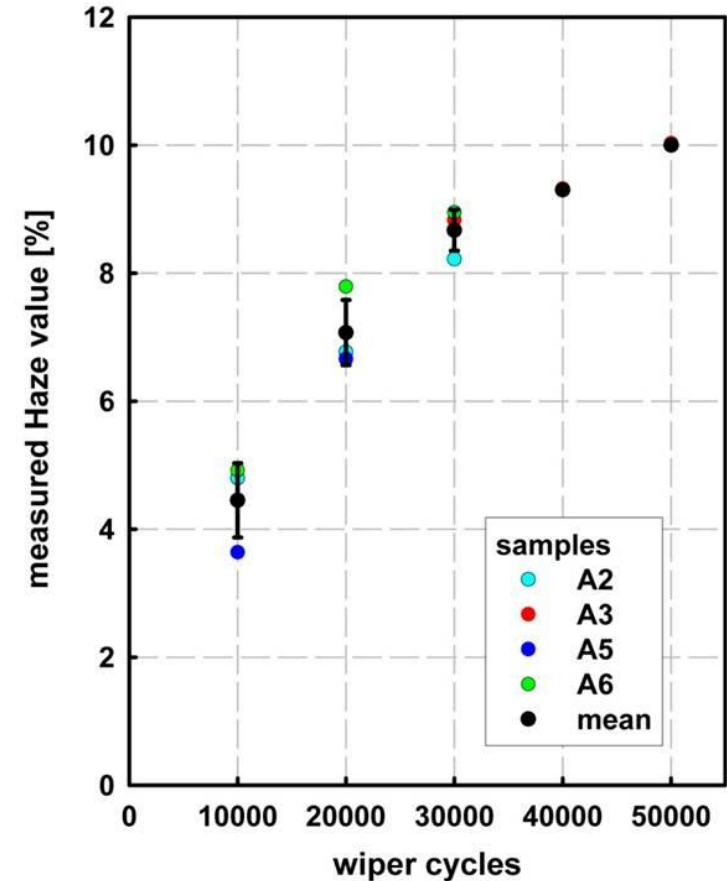


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Results wiper test: Haze values of different materials after wiper cycles

PC coated with UVHC3000

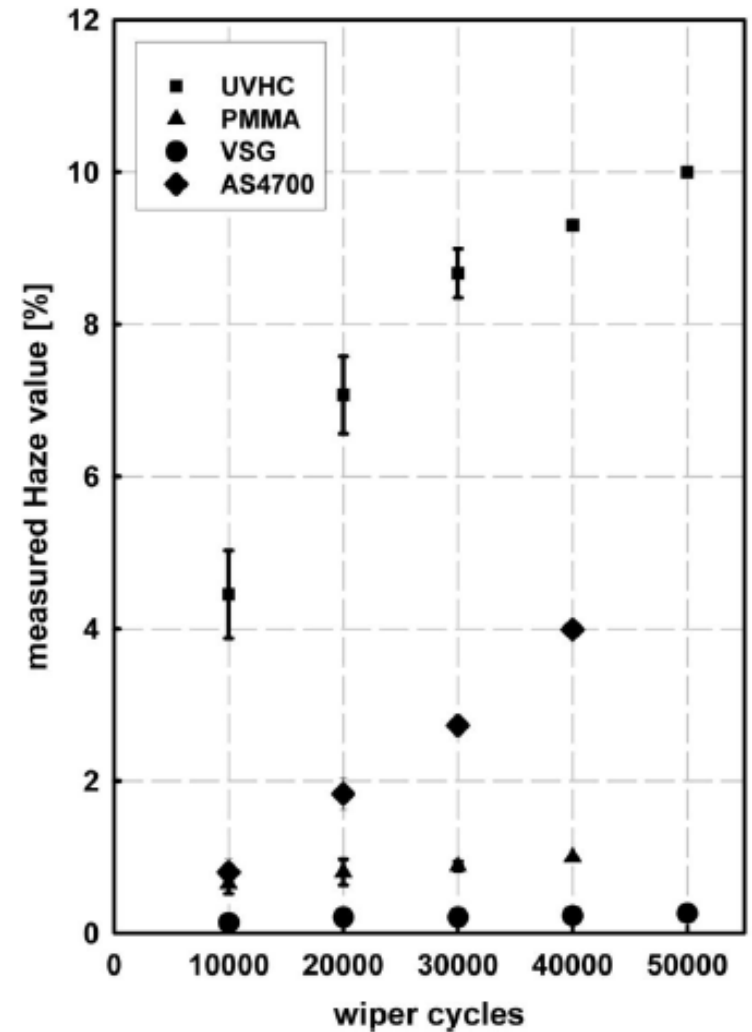
cycles	measured Haze [%]					
	samples				mean	standard deviation
	A2	A3	A5	A6		
10000	4,8		3,64	4,92	4,45	0,58
20000	6,77		6,66	7,79	7,07	0,51
30000	8,22	8,83		8,95	8,67	0,32
40000		9,32			9,3	0
50000		10,03			10	0



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Results wiper test: Haze values of different materials after wiper cycles

All tested materials



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Summary of the results

On-road tests

- ▶ deterioration of glass and plastic glazing through sand impact
- ▶ deterioration of plastic glazing through the wiper:
 - scratches from the beginning of the test
 - also small scratches lead to stray light-effects (danger to be blind)
- ▶ deterioration of glass through the wiper or ice scratcher can only be observed at parts with very high mileage and long use in the car

Wiper test in the lab

- ▶ deterioration of the test samples is similar to the kind of damages observed in on-road tests
- ▶ damages of coated plastic starts with beginning the test (visible scratches after 5000 cycles)
- ▶ glass shows haze at areas of wiper reversal points, no visible scratches

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Conclusions

Test methods for windshield materials

- ▶ Taber test is not a convenient method to show the stress and deterioration of the material, that is realistic to that of windshields in the car
Taber test as method for windshield approval will not supported by the German OEMs (excluding Ford and Opel)
- ▶ Haze measurement as methods to define a criterium for deterioration is only partly convenient, but currently the only one approval method
- ▶ Wiper test is one of the 3 methods, that is realistic to the stress of a windshield in the car

- ▶ Proposal for the regulation document: Wiper test with current test condition (base of the obtained results)
min. 3 test samples
wiper cycles: 50000
criterium: $\leq 0,5$ % Haze

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Conclusions

Use of different materials for windshields in the car

- ▶ Glass is a hard material and convenient for use in windshields
- ▶ Plastic glazing with coatings of the current state of the art is not convenient for use in windshields

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Acknowledgements

Many thanks to



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for Haze measurements

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