

4th meeting of IGPG – 06 to 07 March 2012

“Table of Equivalence”

for comparison of different abrasion test methods
for plastic glazing for windscreens
according to the 3rd meeting of IGPG

Discussion and proposals

(Dr. Buckel, Bayer MaterialScience and Dr. Dümmler, MPA NRW)

Dr. Matthias Dümmler

MPA NRW

Introduction

In the 3rd meeting of IGPG, a “Table of Equivalence” for comparison of different abrasion test methods, summarizing the Round Robin results, was set up:

Test method	Glass		PC + AS4700 (2-layer wet coat)		PMMA + Perma Resist 608 (mono-layer w.c.)	
	Δ haze (%)	Max Δ haze (P=95%) (%)	Δ haze (%)	Max Δ haze (P=95%) (%)	Δ haze (%)	Max Δ haze (P=95%) (%)
Taber	1,17	Ref.: 2,00 (Exp: 1,95)	10,52	37,58	15,57	37,08
Sand drop	3,38	4,78	3,06	4,39	5,01	8,04
Amtec-Kistler	0,19	0,63	0,74	1,83	3,04	6,67

Background information for the discussion of the “Table of Equivalence”

- The IGPG Round Robin (RR) Taber test shows a lack in reproducibility. A revision of the assessment of the Taber test in accordance with the outcomes of the ISO RR has been expected.

Unfortunately the detailed analysis and discussion of the RR data has not been finished by ISO yet. As agreed with ISO/TC22/SC11, the data cannot be transferred to IGPG yet, but a first view shows following:

The ISO test results show significantly better reproducibility than the IGPG results.

However, it must be kept in mind that all the abrasion wheels used in the ISO RR have come from same lots (both Taber wheels and Daiwa wheels). Since IGPG has identified a quality variation among different wheel lots as an important potential source for insufficient reproducibility, the Taber test has not proved to be adequate for plastic glazing yet.

- Wet-coated PMMA (UV-curable coating, mono-layer) shows higher haze values than wet-coated PC (AS4700 2-layer).

In principle, the same coating type used on PC can also be used on PMMA.

=> PMMA haze values could reach similar magnitude as PC haze values
(discussion of material-independent haze limits is simplified).

Taber test

? The reproducibility under real conditions (use of abrasion wheels from different lots) has not been proved to be acceptable for plastic glazing yet. The question how to avoid quality variations among different wheel lots needs further clarification.

? There are still doubts if the test simulates abrasion mechanisms of reality well.

- Testing of real (curved) parts within CoP is not possible.

? A type-independent description of the abrasion wheels, which specifies all relevant technical details, has not been published yet.

Conclusions:

More information from ISO about the suitability of the Taber test for plastic glazing will be available for IGPG not before June 2012 (next ISO meeting).

There are doubts if the final ISO analysis will qualify the Taber test for plastic glazing for windscreens.

=> Drop the Taber test and focus on other test methods (combinations preferred in order to simulate different abrasion mechanisms of reality)!

Sand drop test

- + Acceptable reproducibility.
- + The test simulates one of the abrasion mechanisms of reality.
- + The test is already used for products which are “similar” to windscreens concerning material and field of use (motorcycle-helmet visors).
- + Testing of real (curved) parts within CoP is possible.
- + A complete description of the test procedure is available (sand drop acc. ECE-R22 with haze measurement acc. ECE-R43).

Conclusions:

The sand drop test is suitable for plastic windscreens.

A Δ haze limit of 5 % would glass as well as PC allow to pass the test.

“Table of Equivalence” => same safety level for glass (max. Δ haze = 4,78 %) and coated PC (max. Δ haze = 4,39 %).

Amtec-Kistler test

- + Acceptable reproducibility.
- + The test simulates one of the abrasion mechanisms of reality.
- + The test has been defined for assessing the car-wash resistance of organic paint coatings on vehicle bodies. It is also suitable for plastic glazings, which are likewise elements of the vehicle surface with organic coatings (in this case on transparent substrates). Testing of uncoated (glass) surfaces is also possible.
- + A complete description of the test procedure is available (car wash acc. ISO 20566 with haze measurement acc. ECE-R43).

Conclusions:

The Amtec-Kistler test is suitable for plastic windscreens.

A Δ haze limit of 2 %, which is in line with the current limit for the Taber test, would allow glass as well as PC to pass the test.

(“Table of Equivalence” => glass: max. Δ haze = 0,63 %, coated PC: max. Δ haze = 1,83 %).

Note: A lower limit than 2 % would for no test method be useful because of limited accuracy of the haze-measurement procedure (e.g. nominal reproducibility standard deviation of “haze-gard plus” is 0,4 % haze).

Spray test

? Until now no IGPG Round Robin spray test has been carried out, therefore no own experience about the reproducibility is available in IGPG (ref. ECE-R112 labs).

+ Like the sand drop test, the spray test simulates sand impact as one of the abrasion mechanisms of reality.

- The spray test and the sand drop test should yield similar information about the abrasion resistance, and one of these sand-impact tests would be sufficient.
Compared to the spray test, the sand drop test has the advantage that it is well proved for visor assessment. (Concerning their function in road traffic, motor-helmet visors are more similar to windscreens, than headlamp lenses are.)

+ A complete description of the test procedure is available (spray acc. ECE-R112 with haze measurement acc. ECE-R43).

Conclusion:

For the assessment of sand-impact resistance the sand drop test is sufficient, whereas the spray test should be dropped.

Summary

Proposals as results of the discussion of the “Table of Equivalence” with regard of the spray test as further potential test method:

- Drop the Taber test (for plastic windscreens).
- Keep the sand drop test, set up a Δ haze limit of 5 %.
- Keep the Amtec-Kistler test, set up a Δ haze limit of 2 %.
- Drop the spray test.

Note: These proposals have been set up for the assessment of plastic glazing for windscreens only!