KRD Sicherheitstechnik GmbH

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Meeting of GRSG Informal Group on Plastic Glazing - Paris, 18/19 Jan. 2011

Practical Experience /

Integral Analysis for Human Safety

Practical Experience

Overview delivered plastic glazing from KRD for vehicles since 2001:

10.000 windscreens, monolithic, one-layer
1.500 windscreens, laminated

40.000 side and rear screens, one-layer
9.500 sied and rear screens, laminated

Front windows

Manufacturer KRD
Design Sicherheitsglas
Type KASI 861
Material > PC <
Window number XXXXX

Manufacturer KRD
Design Sicherheitsglas
Certification ~ D 2341
Type KASI 861
Material > PC <
Window number XXXXX

Only vehicles < 40 km/h

A-Pillar

B-Pillar

Rear windows

Manufacturer KRD
Design Sicherheitsglas
Approval mark VIII/B/M E1 43R-001776
Type KASI 433
Material > PC <
Window number XXXXX

DOT-796, AS4, M-40 (M-40GR)

Manufacturer KRD
Design Sicherheitsglas
Certification ~ D 2227
Type KASI 863
Material > PC <
Window number XXXXX

Manufacturer KRD
Design Sicherheitsglas-Doppelscheibe
Certification ~ D 2338
Type KASI SCS 863
Material > PC <
Window number XXXXX

Driver's field of vision

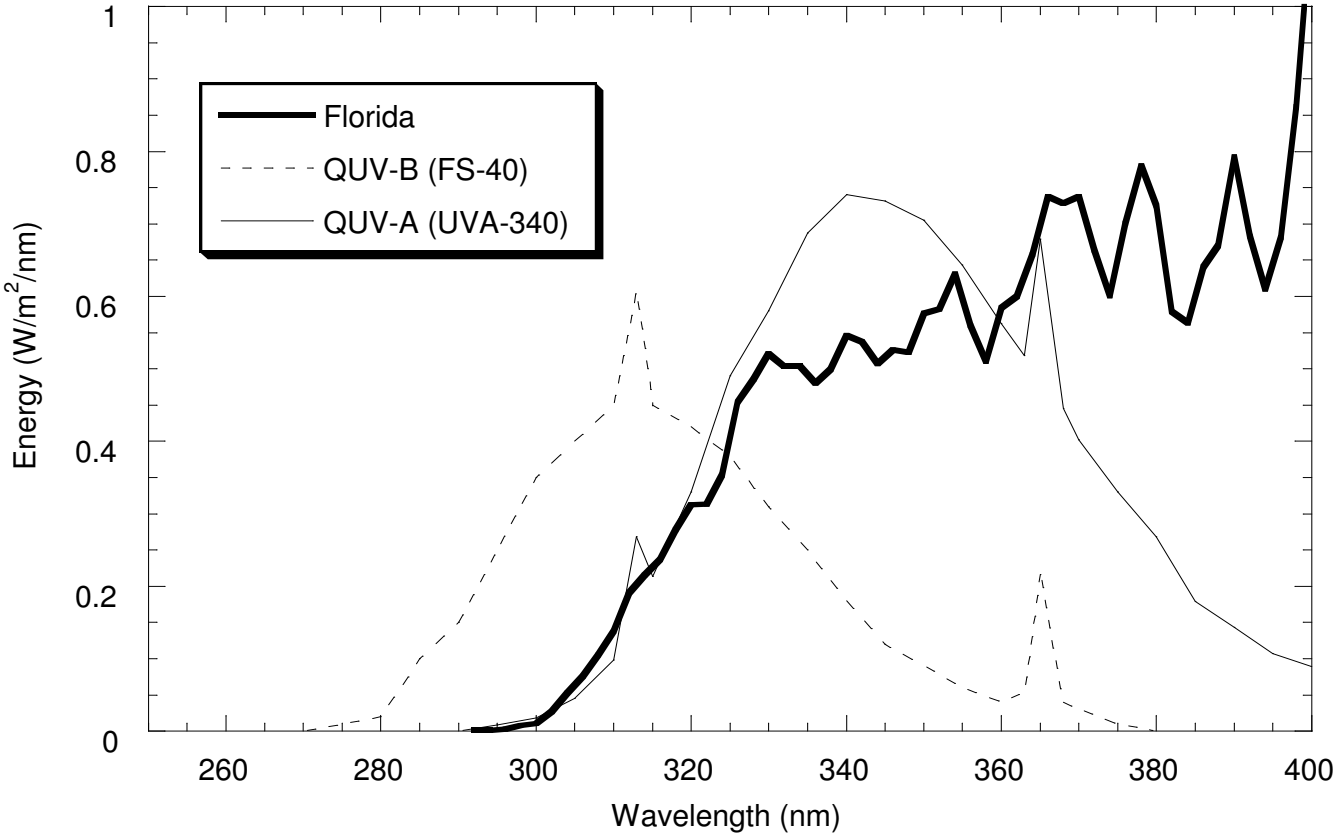
Manufacturer KRD
Design Sicherheitsglas
Type KASI SCS 861
Material > PC <
Window number XXXXX

Manufacturer KRD
Design Sicherheitsglas
Certification ~ D 2227
Type KASI 862
Material > PC <
Window number XXXXX

Type approvals (German ABG; ECE-R43; DOT)

- Flexibility test
- Mechanical strength / Fracture behaviour
- Optics
- Weathering resistance test
- Adhesion properties
- Chemical resistance test
- Fire resistance test
- Resistance to humidity test
- Abrasion resistance test

UV accelerated weathering



UV accelerated weathering / Xenon test

- Spectrum: 295 – 400 nm
  - G26: 0,5 W/m²/nm@340nm -> 59,4 W/m²
    500 MJ/m²/59,4 W/m² = 8,4 x 10^6 s = 2340 h ~14 weeks
  - G26 mod.: 0,75 W/m²/nm@340nm -> 89,1 W/m²
    500 MJ/m²/89,1 W/m² = 5,6 x 10^6 s = 1558 h ~ 9 weeks

  - 1 year Florida ~ 300 MJ/m² (295 – 400 nm)

	G26		G26 mod.	
– 1 year Florida	8,5	weeks	5,6	weeks
– 3 years Florida	25	weeks	17	weeks
– 5 years Florida	42	weeks	28	weeks

- Spectrum: 300 – 800 nm
  - Suntester: up to 765 W/m²; complete dipping into water
    DIN EN ISO 4892 procedure A: 550 W/m²

Chemical resistance

Chemical	Concentration	Result
Acetone	100 %	resistant
Benzene	100 %	resistant
Benzole	100 %	resistant
Chloroform	100 %	resistant
Ethanol	99 %	resistant
Soda lye	40 %	resistant
Diluent for cellulose lacquers	100 %	resistant
Nitric acid	65 %	resistant
Chloric acid	32 %	resistant
Sulfuric acid	98 %	resistant
Xylene	100 %	resistant

Exposure time 10 minutes, 18 – 22°C, the coating is alkali-proof up to pH 12

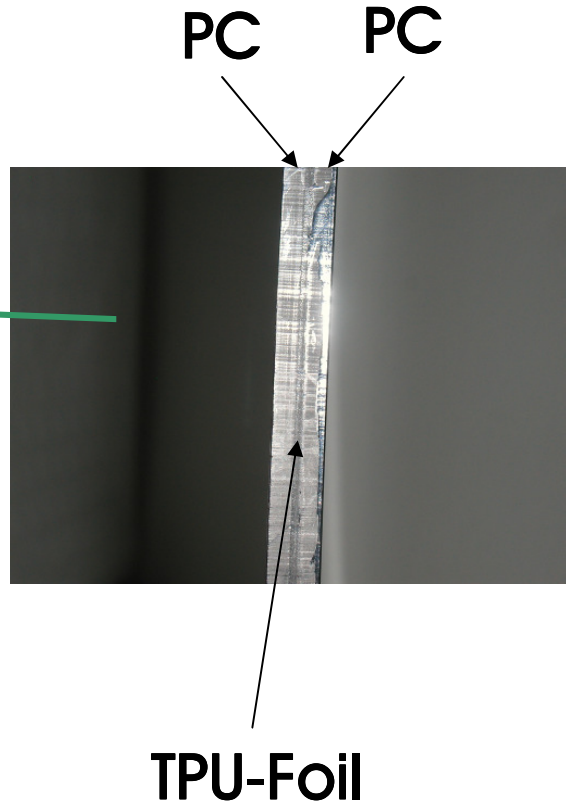
Abrasion resistance (typical results)

Abrasion resistance Taber Test: CS10F wheels, 500g Test results vary with Taber-wheel-batch	Thickness PC	Thickness of layer	Siloxane lacquer X*
Δ Haze @100 rotations			4-6%
Δ Haze @500 rotations			9-12%
Last comparative measurement, adjustment of test conditions, same Taber-wheels:			
Δ Haze @1000 rotations	3 mm	6-8 µm	4-12%

Lacquer X*: Commercially available siloxane lacquers with SAE approval

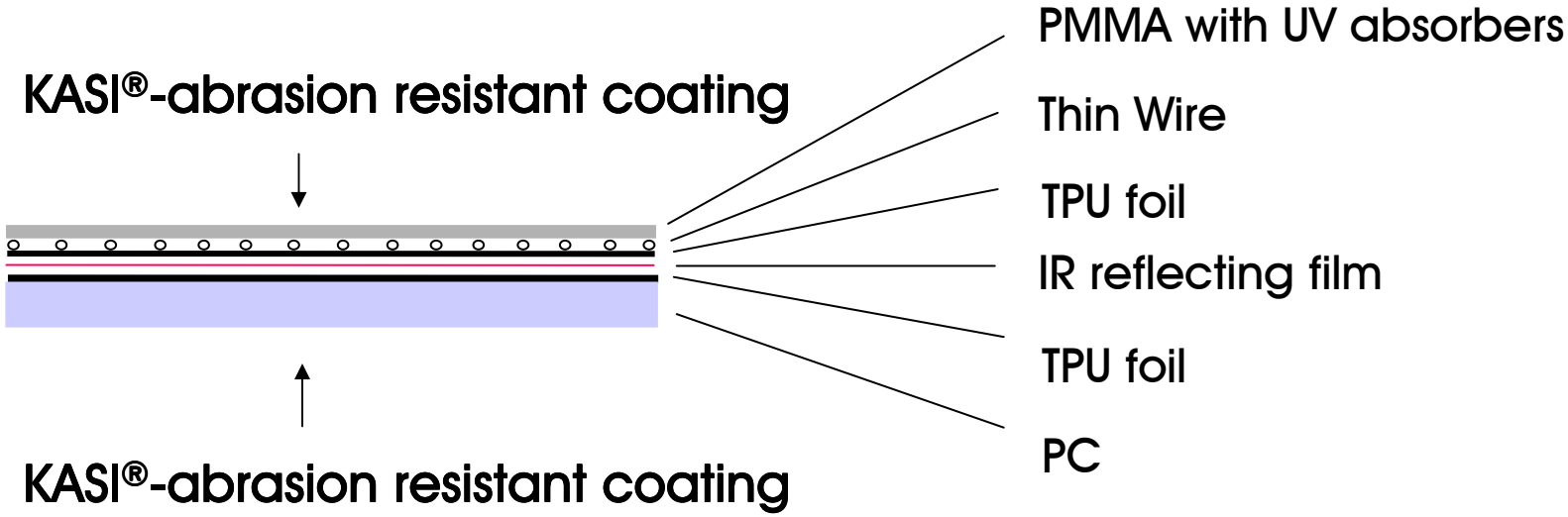
Current development

SCS-V glazing (V = Verbund = laminated)



Automotive glazing with functional properties

UVIREX: protection against UV- + IR-radiation, heatable
Patent pending (construction process)



Actual Situation

- Market requires increasingly individual vehicles
- Fatal accidents require integral analysis
- Materials for glazing (glass / plastics) aren´t comparably
- Public perception regarding crash-behavior of „GLAZING“ is reduced to brittle GLASS or „PLEXIGLASS“
- discussions regarding windscreens simplify:
- plastic windsreens have to achieve glass requirements
- and additional requirements…..

What if 2008 on the motorway A29 the windscreen in BMW was constructed with high impact-resistant plastics ?

Tragic Experience: 23 March 2008, Motorway A29 (Germany)

- „Holzklotz – Prozess“
- 5,9 kg log of wood penetrates BMW-windscreen
- recurrent similar assaults

Source: Spiegel-online / dpa / AP

Proposals

- Same abrasion resistance test / analysis for all plastic glazings:
- Combination Taber (delta-haze <10%) and other test method like e.g. „Amtec-Kistler-Test“ (ISO 20566)

- Same UV- Irradiation test / analysis for all screens:
- delete existing method with <300 nm for laminated glazing

- Others / windscreen wiper test
- use existing solutions based on High pressure cleaning Sytems

- agree on penetration test method (---> KRD video)