

Trends in Automotive Glass



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**GLASS FABRICATION
ENGINEERING
30 YEARS**

**AIRCRAFT TRANSPARENCIES
HIGH IMPACT & BULLETPROOF GLASS
AUTOMOTIVE GLASS**

Trends in Automotive Glass



- Automotive Design / Manufacturing philosophy
- Future glass design trends
 - Size & Shape
 - Configuration
 - Attributes
- Business factors affecting auto glass fabrication
- Fabrication issues
- Alternative to glass

Trends in Automotive Glass

Automotive Design & Manufacturing Philosophy



- Build car to customer's specific order
 - ✦ Striving for 5 day order to delivery time frame
 - ✦ Expand consumer vehicle customization
 - Automakers will offer glass customization options

Trends in Automotive Glass:

Size



- Glass will become larger:
 - ✦ Styling for aerodynamics results in a more pronounced installation angle of windshields and back windows thus making them larger
 - ✦ Windshields and back windows may also extend into roof
 - ✦ Sun roofs may morph into the entire car roof
- Design for reduction in “blind spots”
 - ✦ Windshields may start to wrap around front corners (“A” post)
 - ✦ Back windows may start to wrap around rear corners (“C” post)
- The added glass surface area will increase the importance of the look of glass on cars.

Trends in Automotive Glass:

Shape



- More “complex bends” in glass shape

	<u>Past</u>	<u>Future</u>
○ <u>Windshields</u> :	Cone shape	Cone + wrap
✦ <u>Side windows</u> :	Cylindrical	Compound bend
✦ <u>Back windows</u> :	Flat or cylindrical	Compound bend

- “Amoeba” flat glass shape

- Fit styling of car
- To address window attachments or allow room for internal door components

- Tolerances for shape and size continue to tighten

- Enhance fit and finish of car
 - ✦ Elimination of edge trim, glass is fitted up next to sheet metal (cost reduction)

Trends in Automotive Glass:

Configuration



- Laminated (2.1 mm glass—.030” PVB—2.1mm glass)
 - Very thin glass (1.9 mm)
 - ✦ More glass color selection (primary glass)
 - Coatings:
 - Infrared and UV radiation reflective coatings
 - Antennae applications (phone, radio, satellite)
 - ✦ 42 volt automotive electrical system adoption
 - Heating properties (very quick defrost / defog)
 - Electro chromic (adjustable light transmission)

Trends in Automotive Glass:

Configuration: Laminated (cont)



- Vinyl (PVB Poly Vinyl Butyral)
 - Acoustical
 - ✦ Softer (more plasticizer)
 - ✦ Enhances sound absorption
 - H.U.D. (Heads up Display)
 - ✦ Wire mesh imbedded
 - ✦ Allows driver to keep eyes on the road (safety)
 - Can be colored (current “sun shade” section is dyed vinyl)
 - Heat “reduction” (absorption in vinyl)

Trends in Automotive Glass:

Configuration



- Tempered
 - Thinner glass (weight savings)
 - Coated (different from Windshield coatings)
 - More color variety (primary glass)

Trends in Automotive Glass:

Business



- Auto glass manufacturers in US and Europe are downsizing
- Off shore primary and fabrication operations are on a steep rise
 - ✦ China: (20+ glass manufacturers)
 - Labor and material costs much lower than US
 - ARG product prices are less than raw materials in USA

Trends in Automotive Glass:

Business (cont)



- Auto makers use multiple glass suppliers for same part
 - Common business practice
 - ✦ Reduces risk of assembly plant shutdowns
 - ✦ Pits manufacturers against each other during bid process
 - Bid process occurs 5 years ahead of production
 - ✦ More suppliers to choose from
 - Pilkington: UK, Guardian: USA, Asahi: Japan. Saint Gobain: France, PGW(formerly PPG): USA, Citisa: Mexico, China)

Trends in Automotive Glass:

Business (cont)

- Automakers are unwilling to pay extra for value added products like coated glass.
 - ✦ Does consumer recognize and/or want enhanced properties of “value added” glass
 - ✦ Price is overriding attribute to secure contract (see above bullet item)
 - ✦ 1980’s W/S \$5.00/sq ft, today would love to get \$1.50 / sq ft

Trends in Automotive Glass: Fabrication



- New equipment is computer controlled
 - ✦ Quick pattern changes (no hard tooling)
 - ✦ Very consistent machine operation from “run to run”
 - All operational parameters are saved on part by part basis
 - ✦ Extensive use of visually guided robots
 - Robot Accuracy = +/- .08 mm (+/- ~.003”)
 - “Cost effective” vision system accuracy = +/- .002”
 - ✦ Entering into full vision quality assurance inspection systems
 - More objective than human evaluation
 - Does not miss small “out of specification” defects
 - Currently have to “dummy down” vision systems

Trends in Automotive Glass:

Fabrication (cont):



- Primary glass variation:
 - Primary glass does vary from “run” to “run”
 - Primary glass does vary within a production run
- Fabrication operations had to adjust:
 - Fabrication operations had to process primary glass in chronological production order to gradually adjust fabrication machine parameters to accommodate the changing properties of the glass.
 - ✦ Not following chronological order produced vastly more rejects

Trends in Automotive Glass:

Attributes



- **Safety**
 - **Ejection:** Laminated side windows will reduce occupant ejection during accidents
 - **Burglary:** Laminated side windows prevent “smash and dash” burglaries
 - **Driver attention:** HUD vinyl allows driver to see vehicle information without taking eyes off the road
 - **Protection from debris impact:** Laminated windshield glass still protects occupants from glass shards in the event of debris impact.
 - ✦ Except high speed bird impacts (case study)

Trends in Automotive Glass:

Attributes



- **Improved Driver Comfort**

- Cooler cabin temperatures due to UV and IR reflective coatings.
- Less road noise with laminated windows using acoustical PVB
- Larger field of view due to larger glass openings

- **“GREEN” Value**

- Reflective coatings reduce the air conditioning load thus saving gas and reducing air pollution. (CARB)

Trends in Automotive Glass:

Alternative



- **Polycarbonates:**
- Currently used on headlights, sunroofs, and side windows
 - Advantages
 - ✦ Less weight (50% that of glass, saves gas)
 - ✦ Clear or colored
 - ✦ Can be formed into more complex shapes than glass
 - ✦ High impact fracture resistant (used in bullet proof laminates)
 - Disadvantages
 - ✦ Abrasion resistance, surface not as hard as glass
 - ✦ “Crazing”: Sunlight causes polycarbonate to craze after time. Coatings help slow down the crazing process

Trends in Automotive Glass: (Summary)



- More glass to cover expanded visual openings in cabin
- More colors
- Coated
 - UV and infrared reflective coating keeping cabin cool
 - At 42 volts
 - ✦ Very quick defrost/ defog of glass
 - ✦ Electro chromic applications (car roofs)
- More laminated glass (side and back windows)
 - Safety
 - Quiet
- HUD capabilities
- Polycarbonates may replace glass in certain applications

Trends in Automotive Glass



Questions ?