

# 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, Citsa: 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 ?