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
  - **Past**
    - **Windshields:** Cone shape
    - **Side windows:** Cylindrical
    - **Back windows:** Flat or cylindrical
  - **Future**
    - Cone + wrap
    - Compound bend
    - 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)
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)
• 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
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
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)
**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 ?