Adhesives for Automotive Interiors

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Bostik

Goals for this Presentation

- To supply a starting place or starting tool for those interested in or researching adhesives for automotive interiors
- To provide a broad overview of the most common adhesives used in automotive interiors and the applications where those adhesives are used
- To review the most common methods and processes used when applying these adhesives
- To familiarize the reader with a common glossary of terms that will be used when researching automotive interior adhesives

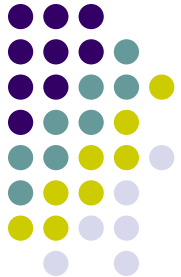
Name that Interior!

The Past

The Present

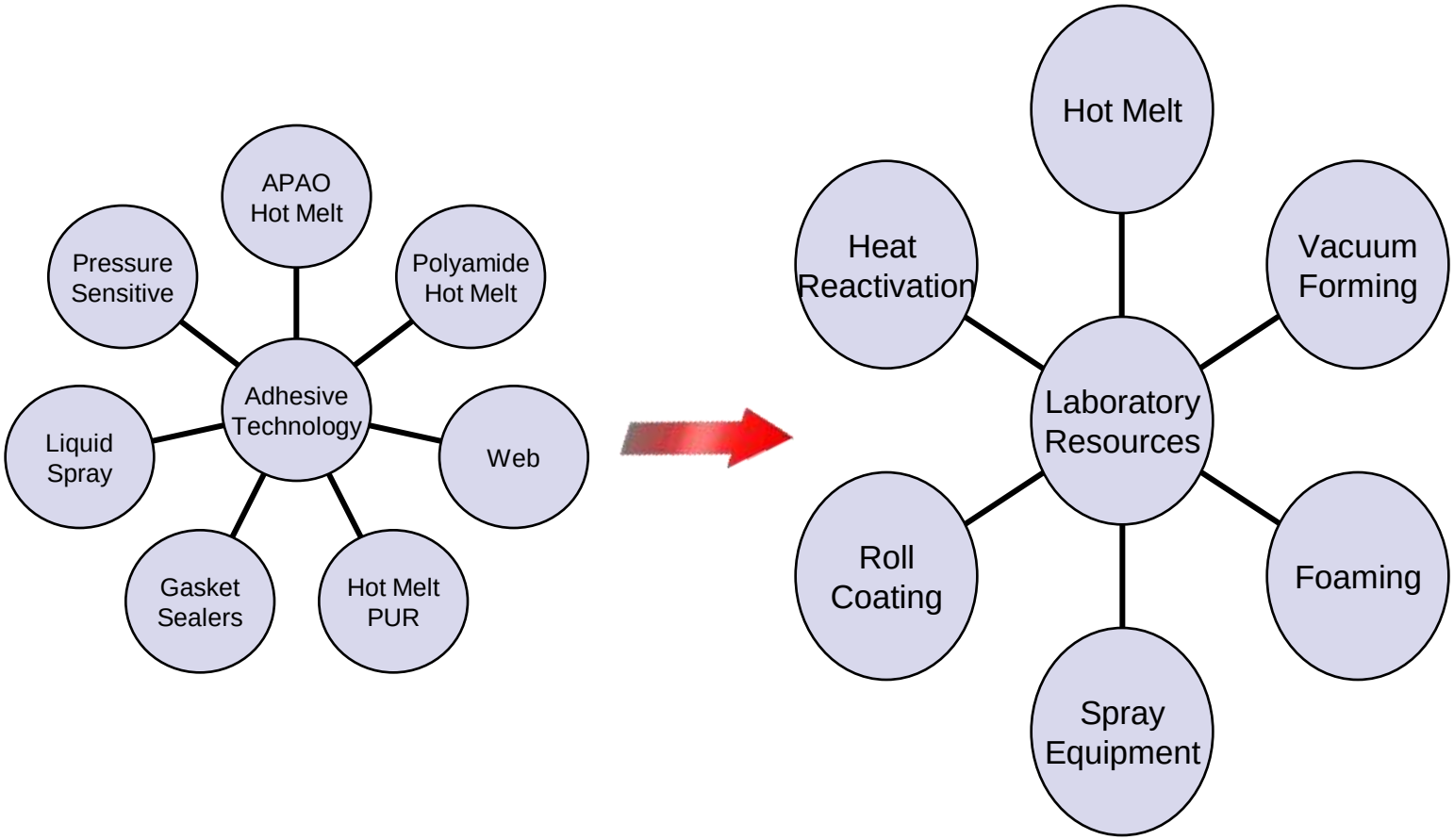
The Future

Starting Questions

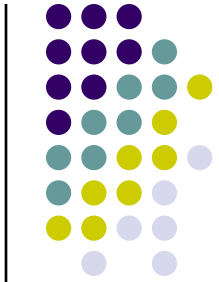


- Does the adhesive or process I am going to use have to be pre-approved by a the specific OEM for whom the part is being made?
- Is this application global in nature? If so is this adhesive available where I will be manufacturing?
- What is the service environment of the adhesive? What environmental screening methods and temperatures will be used? What forces will be placed upon adhesive in this application (sheer, pull, etc)?
- What is my required cycle time? how many parts do I have to make per hour or per shift?
- What is my overall target cost on each part? What is the impact of the different adhesives and their costs to the overall cost target?
- Where is the adhesive going to be applied in the assembly process? How will be handled before and after the adhesive is applied?
- What is the time proper time and environment for the material to be set or cured If required?
- Is an operator required to apply the adhesive or is going to be automated?
- What are my substrates and do they need to be surface pre- treated? Dyne level and substrate technical data should be available from Technical Data Sheets?

The Myriad of Adhesive Choices for Automotive Interior Applications



Types of Automotive Specifications



- **Performance Specifications**
  - These specifications are built upon environmental specifications and cover areas of the vehicle
  - By using these specifications you are keeping all your adhesive and process options available for future engineering changes and cost save considerations
  - This is a the preferred method of all OEM's as we move into the future.
- **Material Specifications**
  - These specifications are built around one particular material – and one particular supplier
  - By using these specifications you are limiting your adhesive and process options for future engineering changes and cost save considerations
  - Except for OEM plant direct materials the OEM's are phasing out these types of specifications

Door Panel Applications

Door Bolster Vinyl Vacuum forming

Insert Bonding
Roll coat
Contact Adhesive
Film Adhesives

Kime Kome

Door Handle
BSR reduction

Speaker gasketing

Carpet Attachment?

Door Panel Applications

Edge turning w / liquid Vac-form or
Hot melt

Duct attachment w/ HM
BSR reduction with FIP

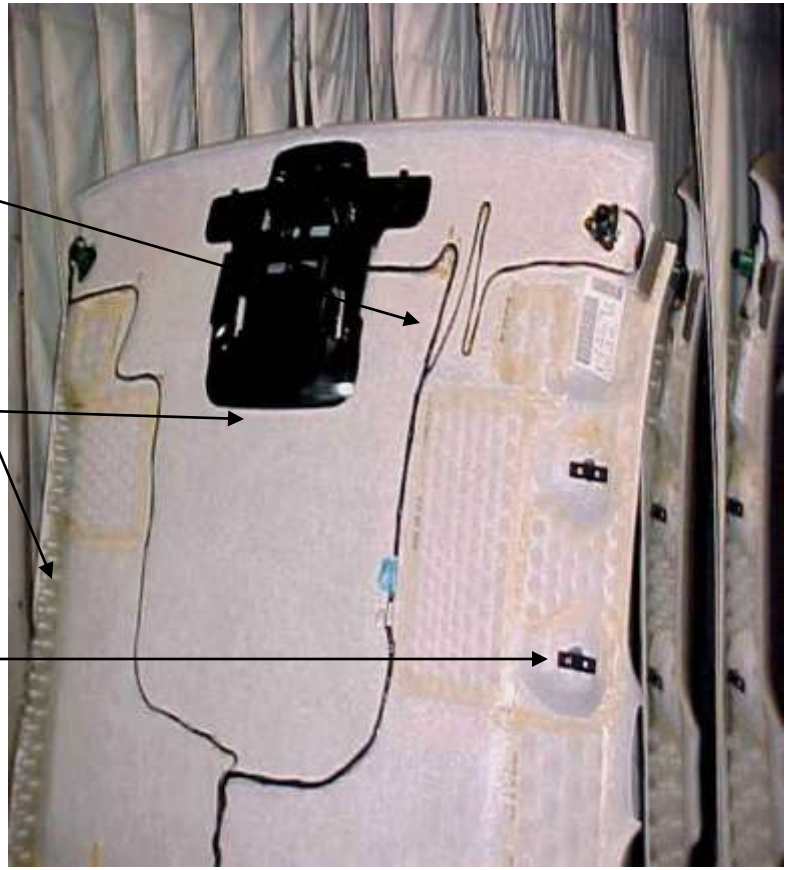
EA foam
Attachment w hot melt

BSR reduction on speakers
W / FIP

Watershields w PSA hot melt
or butyl sealers

Headliner Adhesive Applications

- head-impact composite adhesion
- wire-harness attachment
- water-hose attachment
- HVAC climate control attachment
- stiffener applications
- velcro attachment
- Foam / foam block attachments
- Clip attachments
- Edge folds
- More



Other Common Interior Adhesive Applications

Water Management

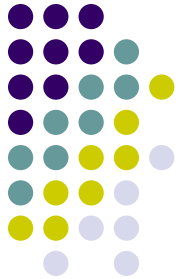
Instrument Panels

BSR / Water Management

Seating

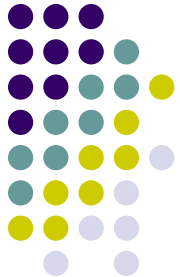
Foam Dam

Types of Adhesives



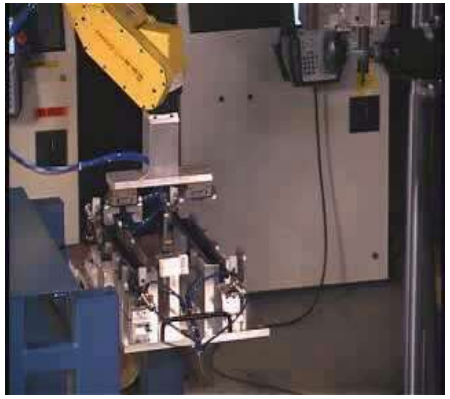
- Hot Melt Adhesives:
  - 100% solids thermoplastic or polyurethane based adhesives that are solid at room temperature and liquefy when heat is applied. These materials form nearly instantaneous bonds due to rapid cooling.
- Liquid Adhesives
  - Typically water / solvent based materials, sprayable or rollcoatable, very low viscosity materials. These materials are typically represented by % solids as the water / solvent is a carrier for the adhesive.
- Web & Pre-Applied Adhesives
  - Hot melt adhesives put into a sheet / film heat reactivatable form.

Types of Hot Melt Adhesives



- APAO: (amorphous-poly-alpha-olefin), a category of olefins that are low in molecular weight and (non-crystalline) amorphous. Best for use on low-surface tension plastics (polypropelene / polyethelene)
- PSA: (pressure sensitive adhesives), adhesive that are permanently tacky at given temperatures. Best for use on ABS / PC higher surface tension plastics.
- Polyamid: (very high temperature resistance, pot life considerations), these tend to be harder / crystalline adhesives based on the use of dimer acids. Best for high-temperature applications with load bearing needs
- Hot Melt Polyurethane: (crosslinking hot melt), Thermosetting hot melt, reactive after processing, these materials once applied do not remelt or flow under heat and pressure. Best for high temperature applications with sustained or very high load bearing needs.

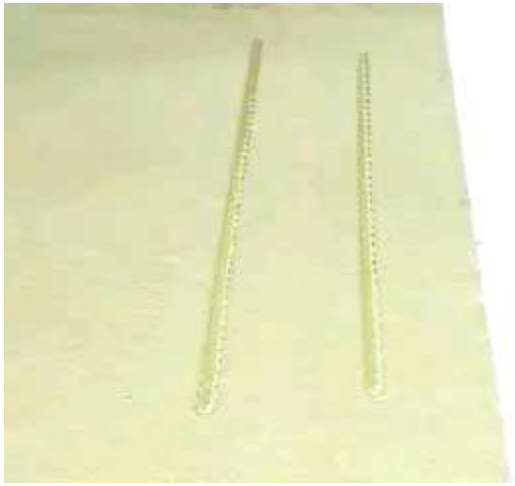
Hot Melt Adhesive Dispensing Processes



Automated dispensing

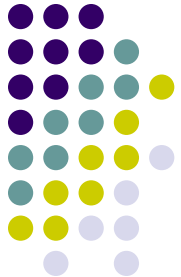
Roll Coating

Swirl spray examples



Unfoamed beads

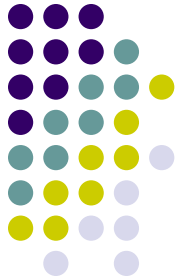
Hot Melt Glossary of Terms



- Viscosity: the measure of an adhesives resistance to flow under specified conditions (temp)
- Melt Point: the point at which the material actually begins to flow
- Softening Point: the point a which it begins flow or sag (maleable, no resistance)
- Ring & Ball Softening Point: The point at which a specified size ball bearing drops below the level of a matched washer to define when a material softens
- SAFT: Sheer Adhesion Failure Temperature: The temperature at which the internal strength of the material fails at a given force
- Open Time: (time from application of a 2-mm bead @ 350F until there is too little tack to pull fibers from kraft paper
- Set Time: (time from application of a 2-mm bead @ 350F until craft paper is destructed rather than the adhesive failing cohesively.
- Cohesive Strength: the internal strength of material, how strong by itself
- Pot life: (AKA: Thermal Stability), the amount of time of polymer can sit at given temperature without losing physical performance
- Glass transition temperature: (TG) the temperature at which a material becomes crystalline Above (TG) is more free moving and below (TG) is more brittle or crystallized.
- Foamability: ability of a material to accept an inert gas and hold it in solution

TDS

Liquid Adhesives

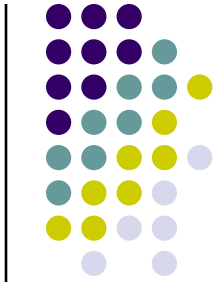


- Materials
  - One-Component Waterbase Materials
    - Drying ovens or drying time is normally associated with these materials while the water carrier of the adhesive is removed after application. A majority of these materials are thermoplastic (non-crosslinking) in nature
  - Two-Component Waterbase Materials
    - The addition of a crosslinking second component makes these materials thermosetting (crosslinking). These materials make high temperature resistant bonds, but require controlled ratio mixing and management of pot life concerns
  - One-Component Solvent Based Materials
    - These materials flash-off or dry faster than one-component waterbased materials, these materials are often used on low surface energy substrates because the solvent that flashes off will “etch” a materials surface. Require special handling and ventilation due to health concerns
  - Pressure Sensitive Materials
    - Drying ovens and dry time are associated with these materials which can be used to cover large areas (either spray or rollcoat) to make an entire surface ‘tacky” or “sticky”. Used for covering large areas with 100% coverage.

Liquid Adhesive Processes

- Spray applied:
  - Think of this as spray paint type application 100% coverage / or large area coverage.
- Roll Coat applied:
  - The adhesive is spread evening over the entire area of an application roller and then evenly applied across an entire area when the part to which the adhesive is applied is rolled over or under-pressure against the roller to which the adhesive is applied.
- Zone Coat applied:
  - Think of this much like screen printing. The adhesive is typically applied though a screen or etched roller process to the adhesive is only applied to selective areas on a part or substrate.
- Vacuum-forming applications:
  - The adhesive is spray applied – dried and then heat-reactivated to create a bond between plastic door frames and coverings (such as: foamed backed vinyls / pvc)
- Contact / Pressure Bonding
  - The adhesive is applied to both substrates to be joined together. The adhesive is wets-out on the substrates is then dried and then joined together with pressure. In most cases the strength of the bond is the strength of the adhesive adhering to itself.
- Kime Kome
  - Typically a zone coat application that require adhesive be used to join multiple substrates in a channel or groove. (AKA cloth, vinyl with plastic insert)

Liquid Adhesive Glossary



- Wet Out:
  - The ability of the liquid adhesive to be evenly / effectively applied onto a given substrate
- Dry Time:
  - The amount of time needed to remove the carrier from the solids. With or without a drying oven or drying device
- Residual Moisture:
  - In some cases such as (vacuum-forming) a small amount of carrier (ex: 5% water) will create desireable tack or adhesion aid. This is refered to as residual moisture.
- Solids Content:
  - How much actual adhesive in contained in the liquid adhesive – liquid is generally just the carrier so a high solids content material will have much more adhesive left on the substrate after drying than a low solids content material. % solids is generally what you should be paying for and solids content should be a important factor in considering any liquid adhesive.
- Dry Weight / Wet Weight:
  - When a part is sprayed there is a weight associated with the adhesive after the carrier is dried or flashed off (dry weight) and the of the adhesive before the carrier is flashed or dried off (wet weight).
- Carrier:
  - The item put into the adhesive to make the adhesive components (solids) deliverable. The adhesive is made into a solution generally with solvent of water as means of making the solids sprayable or coatable the part.

TDS

Web & Film Adhesives

<u>Hot Melt Adhesives</u> **put into a form requiring heat reactivation**

Web & Film Adhesives & Processes

- Polyolefin (olefin, low surface energy substrates)
- Polyester (high temp resistance)
- Polyamid (high temp resistance)

- Processes
  - Pre-applied
    - Applied as backing
  - Insert bonding
    - often die-cut
  - Heat reactivation
    - In composite assemlies

Surface Treatments

It is often necessary to bond plastic materials together. In order to successfully accomplish this adhesives should be able to wet the surface of the material. Wet out depends on one specific property of the surface: surface Energy, often referred to as surface Tension. Surface treatments are designed to increase a substrates surface energy and surface tension making a surface easier to wet out.

*To Reach a Dyne Level 40 or greater

Corona Treatment: Corona discharge equipment consists of a high-frequency power generator, a high-voltage transformer, a stationary electrode, and a treater ground roll.. The treater station applies this power through ceramic or metal electrodes over an air gap onto the material's surface.

- **Plasma Treatment:** Atmospheric plasma is a low temperature source of atoms and radicals. These are delivered to a substrate to clean, remove, modify, or deposit a material of your choice. Plasma offers a broad range of surface chemistries. .

- **liquid & solvent primers:** A liquid coating that is applied to a substrate that is designed to increase its surface tension or to increase a substrates surface energy.

Conclusion

There are an endless variety of different types of adhesives used for automotive interiors today

The substrates, processes, application methods and requirements for adhesives are changing everyday

A majority of these adhesives fall into the categories covered today. Those familiar with the adhesives and processes used today will be those involved with the development of new adhesives and processes in the future.

Million Dollar Interior

One Last Interior

Material Information Resources

- SPE: Handbook of Adhesives and Sealants
  Second Edition: Edward M. Petrie

- ASC: Adhesive and Sealant Council's
  adhesive library www.adhesives.Org

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