



The European voice of the
adhesive and sealant industry

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SAFE ADHESIVES FOR SAFE FOOD



Introduction to the adhesive industry
and the food packaging sector

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Agenda

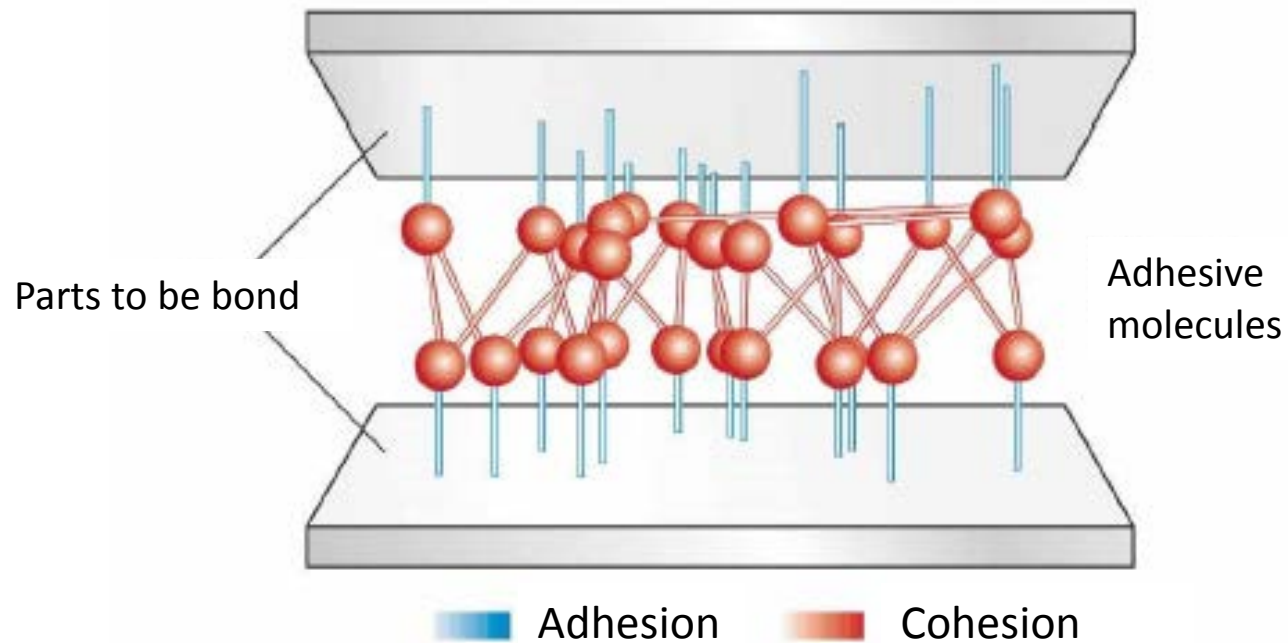
1. Useful facts about Adhesives
2. Regulatory Situation in Europe
3. Short introduction to the different Technologies and typical Applications
4. FEICA tools for Adhesives intended for Food Contact
5. Conclusion

Useful facts about Adhesives

Useful facts about Adhesives

Definition

- An adhesive is a non-metallic material, that binds substrates together by the effects of adhesion (surface adhesion) and cohesion (internal strength).

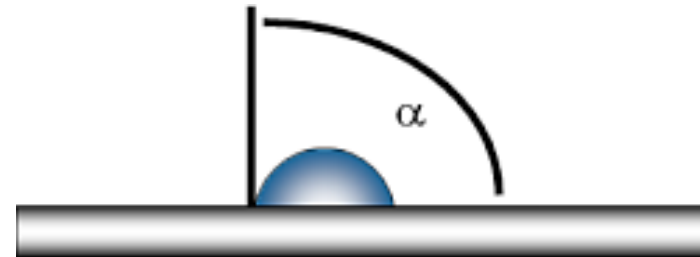


Useful facts about Adhesives

- Adhesives can be used to join almost all materials
- Bonding forces are depending on the size of the contact area
- Gap-filling adhesives might compensate unevenness of the substrates
- Wetting is essential for adhesion
- Wetting depends on the surface tension
- Most adhesives are liquid to allow wetting



Good wetting

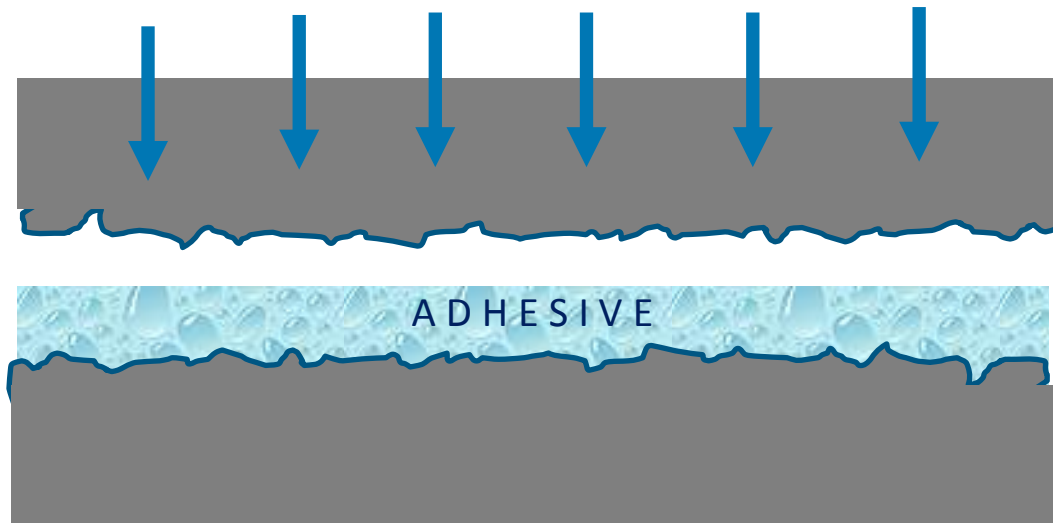


Poor wetting

Useful facts about Adhesives

Possible Adhesion forces

- Chemical bonds: covalent, metallic, ionic
- Intermolecular interactions = Van der Waals forces, hydrogen bonds



Adhesive must be very close to surface



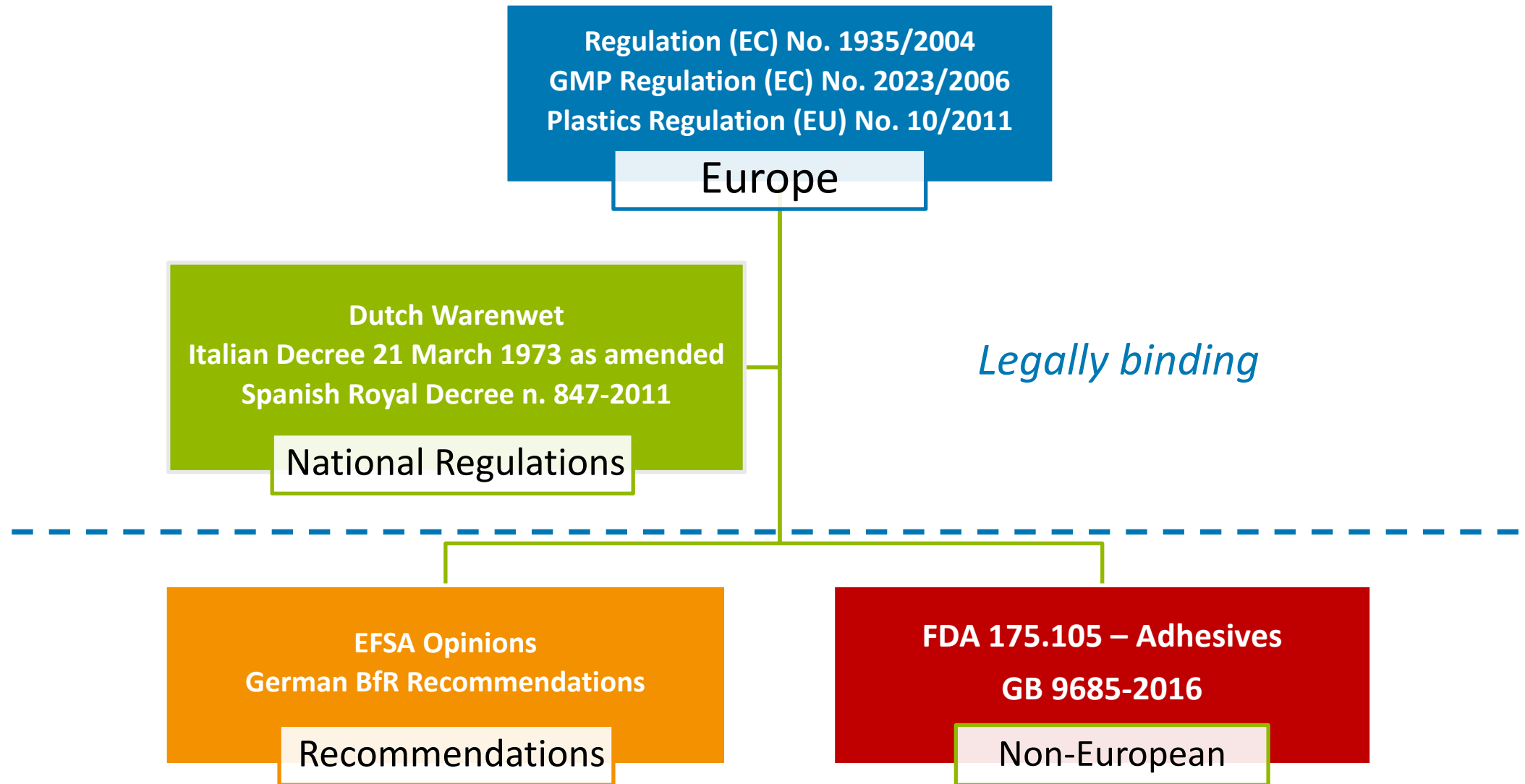
Useful facts about Adhesives

Adhesion/Cohesion-Process

- Application to one or both parts
solution, dispersion, molten polymer
- Joining process
allows wetting of second part
- Open Time
time after wetting, before setting, allows adjustments
- Setting or Curing time
introduces cohesion of the adhesive
- Bonded parts
removal normally only possible through destruction

Relevant Regulations for Packaging Adhesives

Regulations for Packaging Adhesives*



*not comprehensively captured

Regulations for Packaging Adhesives*

Regulation (EC) No. 1935/2004
GMP Regulation (EC) No. 2023/2006
Plastics Regulation (EU) No. 10/2011

Europe

Dutch Warenwet
Italian Decree 21 March 1973 as amended
Spanish Royal Decree n. 847-2011

National Regulations

Legally binding

EFSA Opinions
German BfR Recommendations

Recommendations

FDA 175.105 – Adhesives
GB 9685-2016

Non-European

Mineral Oil
Hydrocarbons
MOH

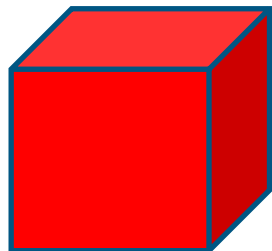
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Difficulties for Adhesive Risk Evaluation

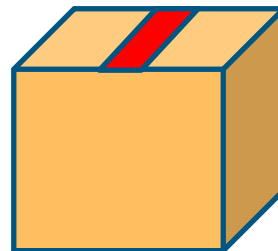
- No European harmonized Regulation for Adhesives today
- Adhesives are not Plastics
- Not all Plastic rules from Regulation (EU) no. 10/2011 can be transferred to adhesives
- Risk assessment by adhesive companies mainly relies on positive listing (10/2011, BfR, FDA, others)

Problems due to missing Adhesive Regulation

- Risk assessment on final material is difficult for the down stream user
- To fulfil Regulation (EU) no. 1935/2004, down stream user considers worst case approach or migration testing
- Worst case calculations are often overestimating real migration especially for paper application
- Simulation of adhesive migration and interpretation of results is difficult, EU-migration model assumes full surface contact



EU-Cube-Approach
1 kg, surface fully covered
 $6 \times 100 \text{ cm}^2 = \underline{600 \text{ cm}^2}$

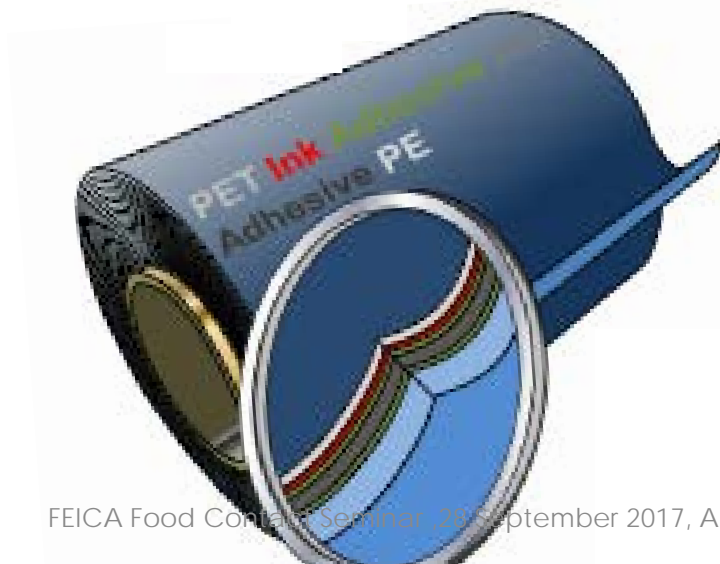


EU-Cube-Approach
1 kg, adhesive touches product partly
 $10 \times 1 \text{ cm}^2 = \underline{10 \text{ cm}^2}$

Different Adhesive Technologies for Packaging Applications

1. Reactive Polyurethane Adhesives

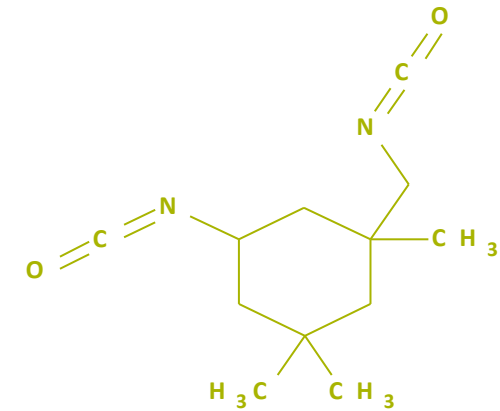
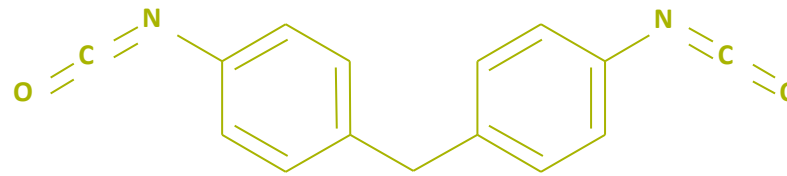
- Purpose: Lamination of different material layers/films
Standard laminates with 2 up to 5 layers
- Differentiation: PUR adhesives with and without solvents
Two component (2K) or one component (1K) systems
- Composition: Reaction of Isocyanates + Hydroxyl group
- Application: Highly diverse material layers may be laminated
PE; PP, OPP, PET, CPA, Al, Paper etc.



1. Reactive Polyurethane Adhesives

Polyurethane Chemistry – Raw Materials

- Typical isocyanate
 - Aromatic (MDI)
 - Aliphatic (IPDI)

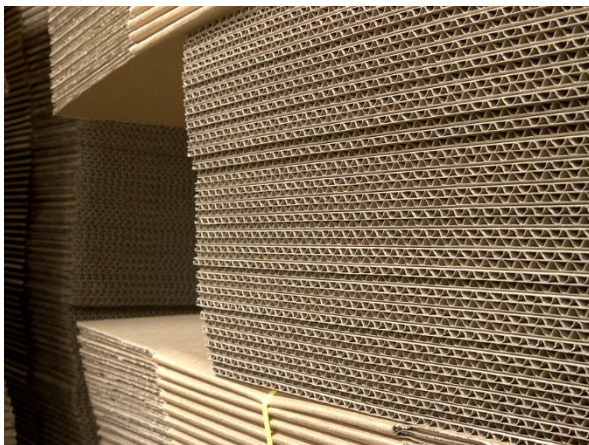


- Typical hydroxyl
 - can be ether or ester
(big influence on final product properties)



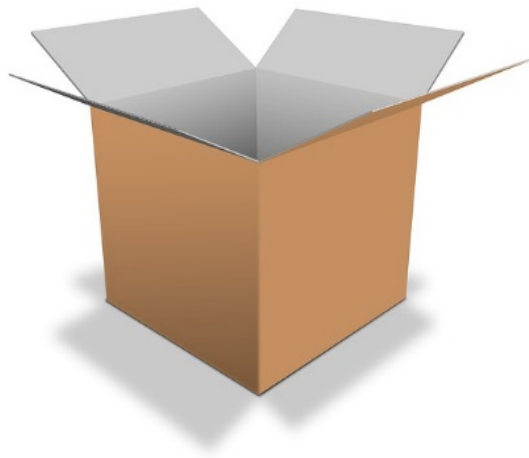
2. Natural Polymeres

- Purpose: Wet lamination of plastic film/paper layers
- Components: Water soluble polymers, based on starch or dextrin
- Application: Preferable for secondary and tertiary packaging, e.g. corrugated board, bottle labelling, spiral wound cores
Combination with other natural proteins possible (e.g. Casein)



3. Dispersions (EVA or PVAc)

- Purpose: For paper and cardboard applications
Wet lamination of paper and film
- Components: Water dispersible polymers - EVA or PVAc based
- Applications: Case and carton construction, kitchen towel or toilet paper, for lidding applications, for tape and label, mainly used for secondary or tertiary packaging



4. Dispersions (Acrylic-based)

- Purpose: Mainly paper and cardboard applications
Wet lamination of paper to film
- Components: Acrylic-based polymer
- Special use: Dispersions for paper/film: closing application on PET, PE or PP substrates
- Applications: Case and carton sealing, for PSA applications as tapes and labels, Labelling of fruits, for closing and reclosable features



6. Cold and Heat Seals

- Cold Seals: Natural rubber latex and synthetic rubber dispersions
Seam sealing application on film and paper, e.g. for chocolate, candy and ice cream
- Heat Seals: Synthetic resin based coatings for film (e.g. polyester, polyethylene, polypropylene) and foil substrates including aluminum, different chemistry possible (polyester, acrylic and vinyl, other).
For tray and cup lids.



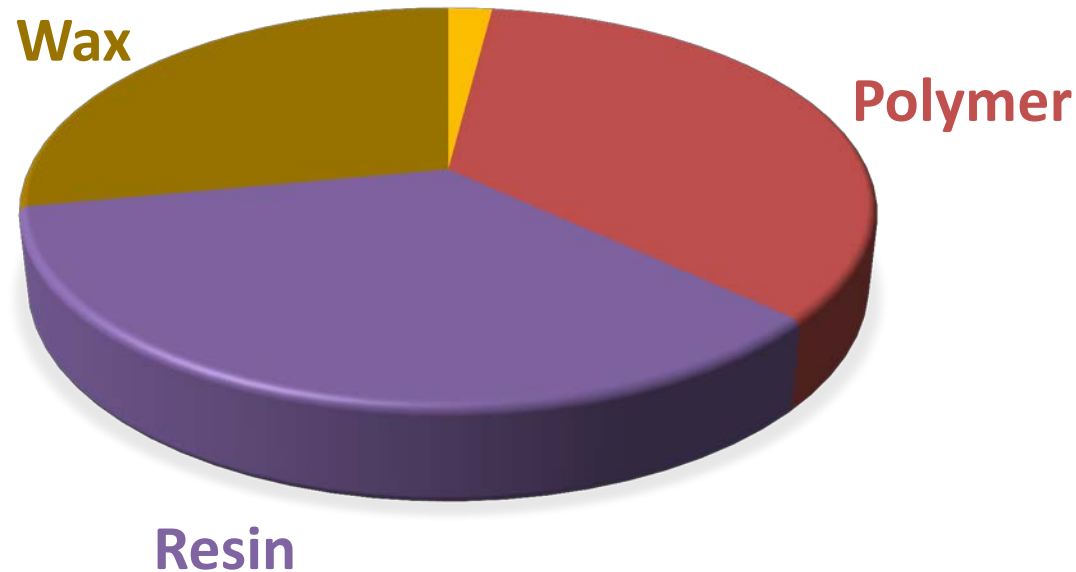
7. Hotmelt adhesives

- Purpose: Quick binding of paper and board
- Application: paper and cardboard packaging of dry foodstuff, mainly for secondary/tertiary packaging
- Components: Wax, Polymer, Resin, Additives



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7. Hotmelt adhesives

Purpose of the waxes

- Consist of: hydrocarbons, higher alcohols, acids and esters or polyolefin
- Main groups:
 - Paraffin's (melting points 45-70°C, MW in general below 500 Dalton),
 - Micro waxes (melting points 60-95°C, MW in general above 500 Dalton)
 - Fisher Tropsch wax (melting points of 100-115°C).

FUNCTION

- Control of open time (OT) - crystallization
- Heat resistance (peel/ shear)
- Determines the softening point

7. Hotmelt adhesives

Purpose of the polymers

- Polymers as Ethylene vinyl acetate copolymer (EVA), metallocene PE, synthetic rubber, APAO, etc.

FUNCTION

- Determines the cohesive properties
- Influences the adhesion
- Controls elasticity
- Molecular weight influences the processing temperature

7. Hotmelt adhesives

Purpose of the resins

- Consist of: polymer mixtures of compounds of non-unified character.
- Derives from: polymerization of low unsaturated hydrocarbons (Ethylene, propylene, butylene, iso-butylene) so called C5-resins or the polymerization of unsaturated hydrocarbons with 9 carbon atoms (e.g. indene, mythylindene, styroderivates) so called C9-resins.

FUNCTION

- Determines the tackiness of the hotmelt
- Influences the wetting properties and the viscosity
- Influences the melt stability

7. Hotmelt adhesives

Purpose of the additives

- Antioxidants
- Colorants
- Plasticizer (e.g. mineral oil for PSA)
- Fragrances

7. Hotmelt adhesives

Pressure Sensitive Adhesives

- Purpose: Pressure sensitive adhesives (PSAs) form a bond by the application of light pressure
- Typical composition: hydrocarbon resin, block copolymer (e.g. SIS, SBS), softening enhancer (mineral oil/paraffinic wax), for elasticity of the product
- Characterization: by their shear and peel resistance as well as their initial tack
- Application: used for permanent or removable applications for tapes, labels, post it's, inserts etc.

7. Hotmelt adhesives

Advantages at a glance

- Quick crystallization – quick binding
- No hazard
- Flexible application – shorter and longer open times
- Alternatives are rare



FEICA tools for Adhesives intended for Food Contact

Tools developed by FEICA to approach the problems

FEICA-Guidances

1. Guidance for a food contact status declaration for adhesives
2. Guidance for Good Manufacturing Practice of food packaging adhesives - Regulation (EU) No 2023/2006
3. Guidance on Migration testing of adhesives intended for food contact materials
4. Guidance on evaluating the food contact status for adhesives containing mineral oil hydrocarbons



Conclusion

- Adhesives cover many different technologies and chemistries
- Adhesives have a huge variety of functions in the food and packaging industry
- Guidance's can fill the gap of missing Regulations for risk assessment

AND finally....Seminars help to develop an understanding within the supply chain