Making of PSA

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Making of PSAs

Although PSAs can be obtained by different polymerization processes (i.e., emulsion, solution, hot-melt, or radiation curing), much attention has recently been devoted to the utilization of more environmentally friendly processes such as emulsion polymerization. Soft polymer networks are commonly used as previous termpressure sensitive adhesivesnext term (PSAs). This is due to their unique ability to deform and yet to resist flow. These contradictory requirements indicate that the mechanical properties are finely tuned, and that the types of deformation upon application are carefully considered. Variety of PSAs can be prepared by mixing a linear vinyl terminated polymer with a silane terminated f-functional cross-linker. Jensen et al., 2009

Sr. No.	PSA process	Chemical composition	Time of launch
1	**Solvent-based**	Rubber/resin, acrylics, silicones	Since 19th century
2	**Hot-melt**	Block copolymers, acrylics	1940s
3	**Emulsion (water)-based**	Acrylics, natural and synthetic rubber, ethylene-vinyl acetate copolymer	1970s
4	**Radiation-cured**	Acrylics, rubber	1970s

Sr. No.	Properties	Solvent-based: acrylic	Hot-melt: styrene-isobutylene-styrene.	Emulsion based: acrylics
1	PS performance	Excellent	Excellent	Very good
2	Ease of compounding	Moderate	Difficult	Easy
3	Formulation flexibility	Limited	Excellent	Moderate
4	Coating method flexibility	Limited	Poor	Excellent
5	Ease of changeover	Limited	Poor	Excellent
6	PSA reproducibility	Excellent	Limited	Excellent
7	Aging properties	Excellent	Poor	Excellent
8	Clarity/color	Excellent	Poor	Excellent
9	Safety/toxicity	Poor	Poor	Excellent
10	Raw material costs	High	Low	Medium
11	Coating/compounding costs	High	Medium	Low

Effect of important parameters on PSA making and performance

Effect of polymer molecular weight and crosslinking reactions on the end-use properties of PSAs

In a study wherein polymer molecular weight and polymer microstructure were regulated using different chain transfer agent (CTA) concentrations and by addition of a diacrylic monomer (MM) it was shown that all of the measured adhesion properties strongly depend on molecular weight of the synthesized polymer and on the amount of gel phase Kajtna et al., 2009

Effect of composition on Mechanical behaviours and fracture energy of PSAs

In a study it was shown that the mechanical behaviour depend on their composition but majority of fracture energy is dissipated on the first millimetre near the bending zone where fibrils elongation is maximum. Observations of interfaces between PSAs and glass substrate underline that fracture energy varies linearly according to the contact area Horgnies et al., 2007

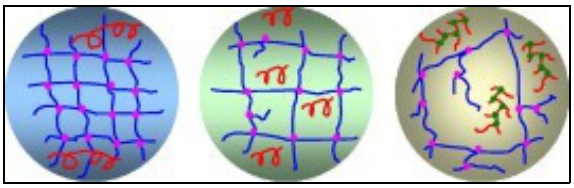
Effect of tackifier on PSAs

To study the effect of tackifier (such as hydrogenated cyclo-aliphatic resin) a model system consisting of polystyrene-b-polyisoprene-b-polystyrene triblock copolymer was prepared. Tackifier increased the peel adhesion significantly and the increase became stronger above 40 wt% tackifier. The

higher peel adhesion was obtained in the system with the larger amount of agglomerates of tackifier in the polyisoprene matrix. Sasaki et al., 2008

Effect of chain transfer agent and cross-linker concentration in making of PSAs

In a study it was shown that a constant cross-linker concentration, one can manipulate the polymer micro-structure by adding varying amounts of chain transfer agent. Three examples of these micro-structures are depicted below which show a tight gel network with long-chain sol polymers, a loose gel network with shorter sol polymers, and an imperfect gel structure with highly branched sol polymers. By manipulating the micro-structure, previous termpressure-sensitive adhesivenext term performance can be affected. Qie and Dube, 2010



Effect of chain transfer agent and cross-linker concentration in making of PSAs

Effect of flexible substrates on PSAs performance

The fracture energy (fracture toughness) of tapes during globally elastic unpeeling is often calculated from the relation G=P/b(1?cos ?). A study suggested that this expression is correct for elastic peeling from rigid substrates but it gives misleading results when peeling from reversible flexible substrates. Steven-Fountain et al., 2002

PSA performance measurement

PSAs polymeric materials effect tack, peel and shear strength . Inherent properties such as copolymer composition and microstructure, molecular weight and distribution are among the most influential factors affecting PSA properties directly as well as indirectly through their influence on physical properties (e.g., the glass transition temperature, Tg) and thus, rheological properties of the polymer (e.g., viscoelastic regions, moduli).

Therefore, PSA is the result of a fine balance between these three major, interrelated properties.

Tack

It is a measure of the force required to remove, say a foam gasket and its adhesive, from the substrate. It usually refers to the initial attraction of the adhesive to the substrate. Tack can be measured by four basic methods these are loop tack, rolling ball, Quick stick and probe measurement devices. Review Of Methods For The Measurement Of Tack

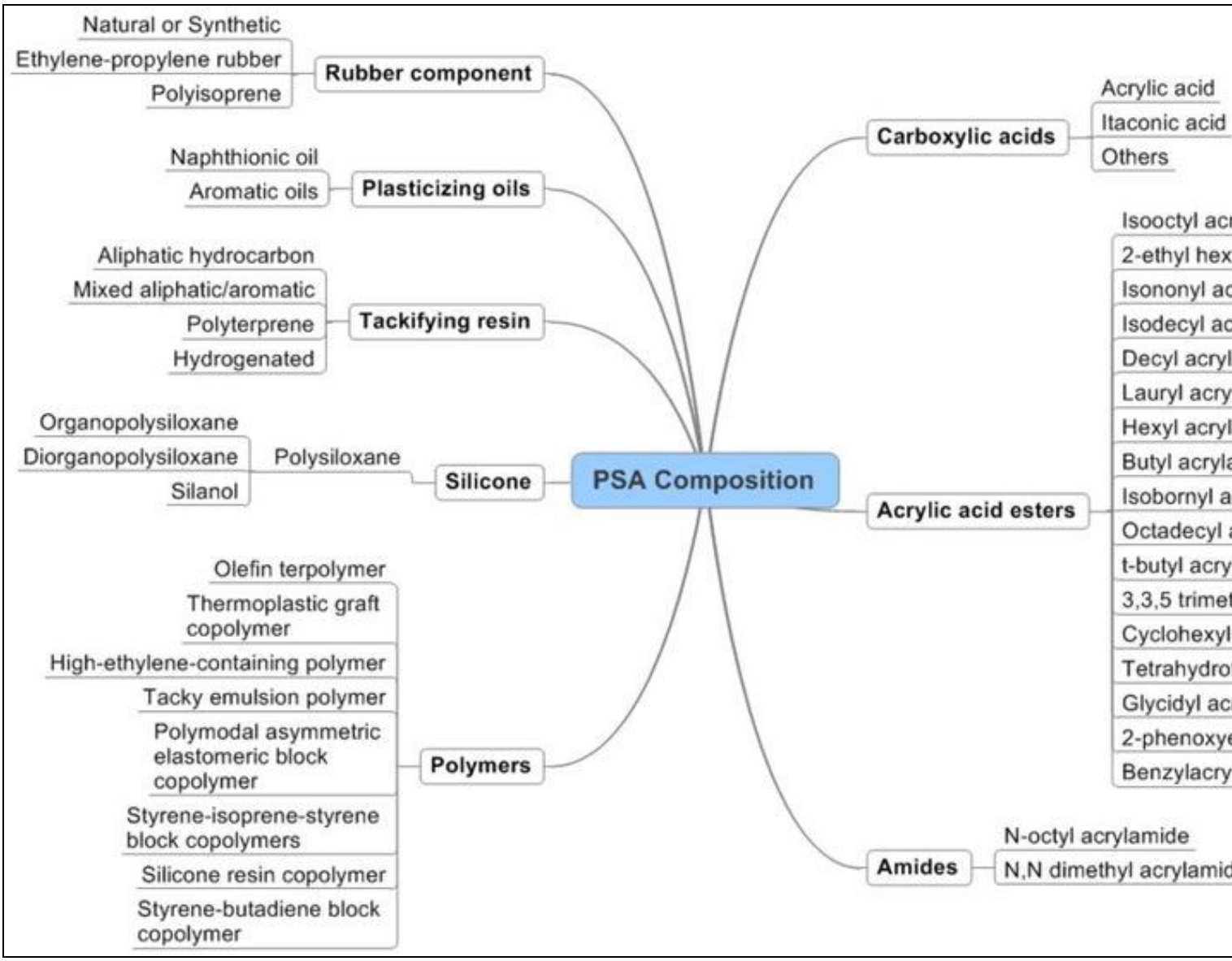
Peel strength

Peel strength is measured as a force required to remove a standard PSA strip from a specified test surface under a standard test angle (e.g., 90° or 180°) under standard conditions. Much like tack, manufacturers control adhesion to create different products based on user requirements. After a PSA has been applied to the substrate, adhesion continues to increase for a period of time ? typically 24 hr.

Shear strength

Shear strength is the internal or cohesive strength of the adhesive mass. Usually, it is determined as the length of time it takes for a standard strip of PSA to fall from a test panel after application of a load. Usually, tack and adhesion decrease as shear strength increases. Emulsion-Based Pressure-Sensitive Adhesives: A Review

PSA Composition



PSA Composition