Focusing on Tape

Part Two

In this publication we examine the three principle groups of Adhesives used in Pressure Sensitive Adhesive manufacture.

By understanding the differences between these Adhesives we hope that you can make the right decision when selecting the best packing tape for your particular application.

Part Two

There are three principle groups of adhesives used in pressure sensitive adhesive manufacture.

These are:

Acrylic adhesives

Natural Rubber adhesives

Synthetic Rubber adhesives
which are otherwise known as **Hotmelt adhesives**.

Within these groups, there are many variations and distinctive features and it is not always possible to predict the exact performance of an adhesive simply by knowing the type of adhesive.

There are, however, particular features that are typical of every adhesive type, and being aware of them can help you make the right decision as to the best adhesive for your particular application.

Rubber-resin adhesives & Acrylic Adhesives

Rubber-resin adhesives are natural rubber or synthetic-rubber-based and are formulated with tackifying resins, oils, stabilisers, and sometimes, curing agents.

Acrylic adhesives are made of industrially synthesised polymers that are often mixed with a curing agent and can be specifically adjusted to produce the adhesive properties required of a product.

The Hevea brasiliensis tree
Adhesives made from natural rubber, which is essentially polyisoprene, are very tacky and are used in pressure sensitive applications.

- Natural rubber adhesives are made from natural polymers derived from the Hevea brasiliensis tree
- Synthetic rubber adhesives are made up of industrially manufactured synthetic thermoplastic polymers

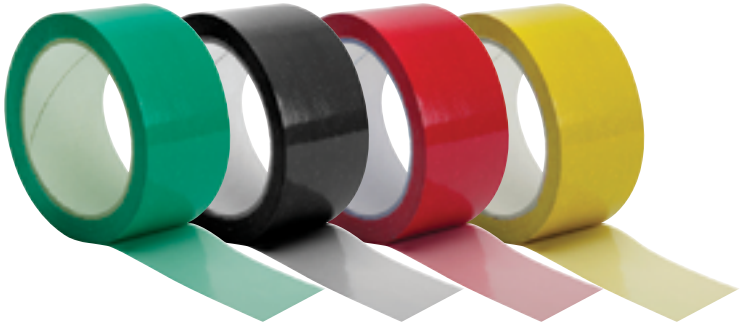
***Polymers** are large molecules composed of repeated chemical units. The smallest repeating unit is called a mer. The term polymer is derived from the Greek words poly and mers meaning "many parts."*

Performance

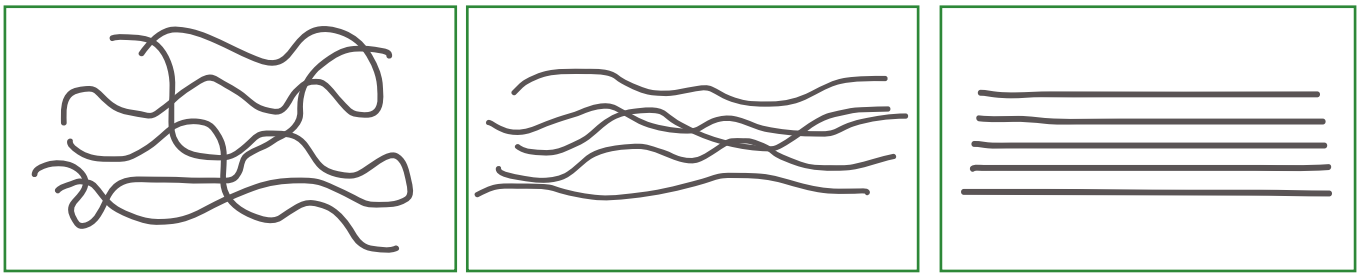
Rubber Adhesives	Acrylic Adhesives
High initial adhesion or 'Grab'	Fair initial adhesion
Good shear strength	High shear strength
Moderate temperature resistance	High temperature resistance
Good solvent resistance	Excellent solvent resistance
Fair UV resistance	Excellent UV resistance
Moderate durability	Excellent durability

Under the spotlight:

Natural Rubber Adhesives



Natural rubber was the first material used to manufacture pressure sensitive adhesives. Natural rubber naturally is not tacky, and neither is it an adhesive. Therefore, tackifier resins are added to create the pressure sensitive adhesive.



Rubber molecules in a crystal

One characteristic of natural rubber is the very long polymer chains that are intertwined with each other. This gives the benefit of flexibility even at very low temperatures, and gives the cohesive strength of natural rubber adhesive.

This characteristic means that natural rubber can be used for many applications. The type of rubber used, types of resins and other ingredients will govern the performance of the natural rubber adhesive.

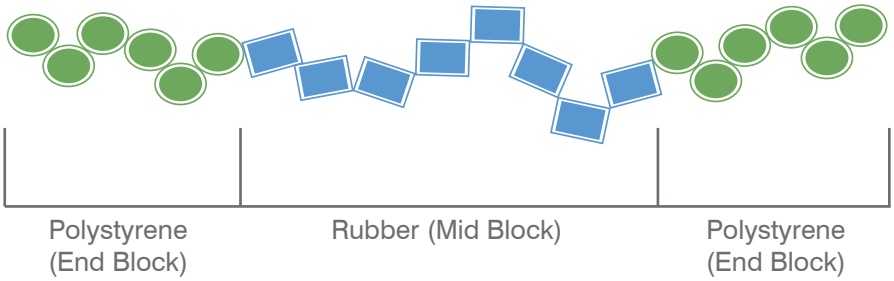
Pro's and Con's of Natural Rubber Pressure Sensitive Adhesive

Pro's	Con's
High initial tack or 'Grab'	Poor cohesion at higher temperatures (T>70°C)
Very good peel adhesion on non-polar and polar surfaces	Poor aging resistance
Transparent coatings possible (in contrast to Natural Rubber) Very high initial bond to substrate possible	Low environmental resistance (needs stabilizers) to protect against UV, ozone, etc
Low cost due to high speed manufacturing process	Poor chemical and solvent resistance

Under the spotlight:

Synthetic Rubber Adhesives

Otherwise known as Hotmelt Adhesive, Synthetic Rubber Adhesives are made from Block Copolymers, usually **Styrenic Block Copolymers**. The molecular structure of a Styrenic Block Copolymer consists of two hard polystyrene blocks on each end, and a softer, more malleable elastomeric segment in the centre. See illustration below.



Hot melt based adhesive provides a strong adhesion to corrugated cases and general packaging. A general purpose, cost effective packaging tape available in both clear and tan. Pressure sensitive adhesive coating makes this tape ideal for corrugated packing, bundling and sealing.

When a high temperature has been achieved, the Polystyrene disintegrates in such a way that the Styrenic Block Copolymers then can be processed in the same way as Thermoplasts are.

In the Hot-melt process, Thermoplastic Rubbers have tackifying resins added as well as oils and antioxidants.

The (Hotmelt) Adhesive is coated onto the backing tape at temperatures up to 150°C. one difference when compared with Natural Rubber is that the Synthetic Rubber polymer is short and has a low molecular weight.

Thermoplasts:
These are a rubber like material that can be processed with thermoplastic technologies such as injection moulding.

Pro's and Con's of Synthetic Rubber Pressure Sensitive Adhesive

Pro's	Con's
High initial tack or 'Grab'	Low resistance to higher temperatures
Very good peel adhesion on non-polar and polar surfaces	Poor aging resistance but better than Natural Rubber
Transparent coatings possible (in contrast to Natural Rubber)	Low environmental resistance (needs stabilizers) to protect against UV, ozone
Very high initial bond to substrate possible	Moderate solvent resistance
Low cost due to high speed manufacturing process	

Under the spotlight:

Acrylic Adhesives

Acrylic Monomers are the raw materials used in Acrylic Adhesive. Acrylic Monomers are also used in contact lenses, plastic glass and Water-absorbing Polymers. By selecting and Polymerising these Acrylic Monomers it is possible to synthesise Acrylic Polymers with certain functions and use them as an adhesive.

Methods of synthesising Acrylic Polymers include:

Solution Polymerisation, Emulsion polymerisation and UV Polymerisation.

In recent years with the increase in awareness of global environmental conservation, Emulsion Polymerisation and UV Polymerisation have been becoming more popular as they do not require the use of Organic Solvents which produce VOC's (Volatile, Organic, Compounds).

As opposed to Natural Rubber and Synthetic Rubber Adhesives, Acrylic Adhesives are tacky by nature.

Acrylic adhesives also have long polymer chains that are cross-linked. This means that Acrylic Adhesives give higher performance than Natural or Synthetic Rubber Adhesives in some applications. But, when used for packaging items, Acrylic Adhesives sometimes do not perform so well under certain conditions and for certain applications.

Pro's and Con's of Acrylic Pressure Sensitive Adhesive

Pro's	Con's
High transparency	Low immediate peel adhesion
Good aging resistance (does not yellow)	Longer dwell time
High temperature resistance	Lower adhesion on non-polar substrates
High resistance to UV and moisture	
High resistance to solvents and plasticisers	
Very good peel adhesion on polar surfaces	

Summary

Acrylic Adhesives are excellent for long term outdoor applications, but their low initial 'grab', and longer dwell time, can cause problems in high volume packing situations where a high initial 'grab' is needed, for exa box or parcel remains securely sealed after application.

testvalley PACKAGING

Next Week...

We will take an in-depth look at how tape is manufactured by comparing traditional manufacturing processes against Hotmelt.

www.testvalleypkg.co.uk
sales@testvalleypkg.co.uk
01722 414 800