The pressure sensitive adhesive (PSA) tape market is projected to grow exponentially by the year 2020. Given this potential, it is advantageous to obtain a thorough understanding of the technologies associated with developing, manufacturing, specifying, and utilizing today’s advanced pressure sensitive adhesive tapes.

What is a Pressure Sensitive Adhesive?
A pressure sensitive adhesive is a permanently tacky substance that adheres to a given surface when light pressure is applied. A pressure sensitive adhesive maintains a fine balance between adhesion (holding power of the adhesive on external substrates) and cohesion (holding power of the combined internal components of the adhesive). PSAs do not require a chemical reaction to develop adhesion forces.

### Pressure Sensitive Tape Components and Key Terms

| **Adhesive:** Typical adhesives are acrylic, natural rubber, or synthetic rubber. Special adhesives with a smaller application base are silicone, butyl, or EVA (ethylene - vinyl - acetate). |
| **Backings:** A backing (or carrier) is a relatively thin, flexible, web-based material. It can be made from various kinds of materials, such as paper, film, foil, foam, fabrics, non-wovens, and laminates. Backings are often chosen due to the function they fulfill, such as cushioning, dampening, maintaining a barrier, etc. |
| **Primer:** A primer is used to increase the holding power of the adhesive to the backing. The primer can be a liquid substance coated onto the backing material, or a physical treatment, such as corona or flame treatment. This is especially important if the tape needs to remove cleanly, or if the tape is stressed permanently with a load. |
| **Release Liner:** A release liner is mainly used with double-sided tapes. Siliconized papers or films are the main types of release liners. The optimal liner choice depends on the application. If die-cut ability is required, polyester liners are preferable. If the tape is exposed to humidity, poly-coated papers are mainly used due to their dimensional stability. For most applications, paper liners are the liners of choice. |
| **Release Coating:** The backing of a single-sided tape, and the release liner for a double-sided tape, are treated with a release coating. The release coating ensures stable unwinding of the tape during the application. This is very important for automatic applications in which the tape can be unwound at high speeds. A release coating can have different release forces for either easy unwinding or harder unwinding, depending on the customer’s needs. |
| **Adhesion:** Adhesion is the attraction force between adhesive and substrate, which depends on the adhesive, the substrate, and the application conditions such as: application pressure, time period of pressure, and temperature during application. |
| **Cohesion:** Cohesion describes the inner strength of an adhesive. It is relevant for applications where the force, in effect, is parallel to the bonding area. High cohesion goes hand-in-hand with high temperature resistance, low-edge picking, and high holding power or shear resistance. |
| **Tack:** Tack is the wetting capability of an adhesive to the substrate at first contact. Tack is effective under minimum pressure and for a short period of contact time. For most applications, tack is not relevant because time is required to press the tape to the substrate. For applications such as flying splices in the paper and print industry, tack is an important criterion. Tack also supports adhesion on rough surfaces. The thumb test is often used to characterize an adhesive, even though it gives no indication of the adhesion or the overall tape performance. |
| **Shear:** Shear is the ability of an adhesive to resist creep or slippage. |
| **Tensile Strength:** Tensile strength is mainly important for single-sided tapes where the backing for the particular application has to withstand tensile stress. Carton sealing tapes or strapping/bundling applications are most important. The tensile strength of tape is usually not important for double-sided tapes, as long as the bonding materials are not stretchable. |
| **Elongation:** Elongation is the percentage in which a tape can be stretched prior to breaking. |
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Predominate Types of Adhesive Tapes

Single-Sided Tape
For single-sided tapes, the backing can be comprised of a variety of flat web-based materials, such as film, paper, foil, fabrics, or foam. In many instances, the backing is treated with a release coating to enable stable unwinding forces, or with a primer to ensure that the adhesive sticks to the correct side of the backing.

Double-Sided Tape
For double-sided tapes, the backing is coated with a pressure sensitive adhesive on both sides. The backing materials can be the same as any of those mentioned for single-sided tapes. A release liner is utilized to prevent the adhesives from sticking to themselves. The release liner is normally a silicone-coated paper or filmic material.

Transfer Tape
A transfer tape is considered a specialty product, as it does not harbor a backing material. The pressure sensitive adhesive is coated onto the release liner and wound onto a roll. A release liner is always part of the transfer tape structure.

A Look at Tape Liners
A variety of tape liners are available based on specific application needs. Key features and benefits of the most common liners are detailed in the chart below.

<table>
<thead>
<tr>
<th>Tape Liners</th>
<th>Glassine Paper</th>
<th>PE-Coated Paper</th>
<th>PP Film</th>
<th>PE Film</th>
<th>PET Film</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness Tolerances</td>
<td>O</td>
<td>O</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Costs</td>
<td>+</td>
<td>-</td>
<td>O</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Hand Tearability</td>
<td>+</td>
<td>+</td>
<td>-</td>
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<td>-</td>
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<tr>
<td>Humidity Resistance</td>
<td>-</td>
<td>+</td>
<td>+</td>
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<tr>
<td>Die-Cut Ability</td>
<td>+</td>
<td>O</td>
<td>+</td>
<td>-</td>
<td>O</td>
</tr>
<tr>
<td>Kiss-Cut Ability</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>-</td>
<td>+</td>
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<tr>
<td>Tensile Strength</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

1 PE - polyethylene  
2 PP - polypropylene  
3 PET - polyester  

Low  
Medium  
High
As the name indicates, pressure sensitive tapes need pressure to ensure bonding. The recommended bonding pressure is 14.5 – 29 psi \( \pm 10 – 20 \) N/cm². The pressure is needed to ensure that the tape comes in close contact to the surface so that the physical forces between the adhesive and the surface can build up. The tape should be applied at moderate temperatures between 59º F and 95º F. Lower temperatures might lead to insufficient “wetting” (coverage) of the adhesive on the substrate. Extremely high temperatures might cause the tape to stretch when being applied, which could create additional stress in the final application.

### Surface Preparation

The surface to which the tape is applied should be clean, dry, and free of oils or grease. To properly clean the surface, a “lintless” cloth should be used. Suitable solvents for use include benzenes, alcohols, esters, and ketones. Ensure that the substrate is able to withstand the solvent prior to application.

### Surface Energy/Tension

To ensure the best possible adhesion, it is optimal that the surface onto which the tape is applied has a higher surface energy or polarity than the tape’s adhesive system.

There are some substrates that are generally easier to bond to than others. These are the materials with higher surface tension/energy. It is important to know that coatings on the surfaces or fillers in the substrates might influence the adhesion characteristics. A painted aluminum or plasticized PVC (polyvinyl chloride) might display completely different bonding characteristics as compared to pure, unaltered materials.

### Proper Application of A PSA Tape

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### Storage Conditions

Pressure sensitive tapes need to be stored under defined conditions.

**Extreme high temperatures can lead to degradation of the adhesive or backing materials.**

**Extreme low temperatures might influence the bonding characteristics.**

The recommended storage conditions are:

- 68 - 72° F / 20 - 22° C
- 50% relative humidity
- Rolls store flat in their original packaging, away from direct sources of UV (i.e., lights, sun).
How Pressure Sensitive Tape Is Manufactured

Traditional Production Process

The ingredients – adhesive, resin, filler, and other additives are mixed with organic solvents or water.

The solved adhesive is transported to the coating device, after which the adhesive is coated in an even layer onto the backing and dried in the drying channel until all the solvents have evaporated. The result is a long roll of tape. After the coating process, the long rolls are converted into the desired roll sizes.

Hot-Melt Process

In the hot-melt process, the adhesive and other ingredients are processed without solvents. Due to heat in the process, the adhesive remains in a liquid state to be coated.