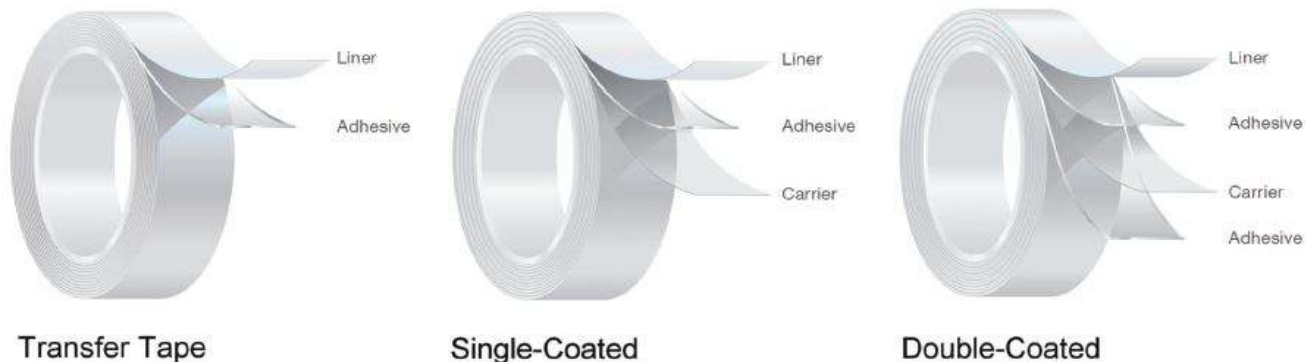


## Pressure Sensitive Adhesive Tape Construction

### What is a Pressure Sensitive Adhesive (PSA) Tape?

**Pressure sensitive adhesive tape** can be defined as a continuous flexible strip of cloth, paper, metal, plastic or foam coated on one or both sides with a permanently tacky adhesive at room temperature which will adhere to a variety of surfaces with light pressure (finger pressure) with no phase change (liquid to solid) and usually in roll form. PSAs can be blends of natural or synthetic rubber and resin, acrylic, silicone or other polymer systems, with or without additives. *Pressure Sensitive Tape Council (PSTC)*

### What are the Components of PSA Tape?



### Single Coated Tapes

For a single coated tape, an adhesive is applied to only one side of the backing. The backing composition may be paper, polymeric film, foil, nonwoven or high thread count woven cloth. The adhesive composition may be an acrylic, rubber or silicone based adhesive system. The tape may be self-wound with a release coating applied to the backing or it can be lined with a paper or film release liner.

Examples of single coated tapes are electrical, masking, carton sealing and medical tape. Some single-coated tapes, such as filament tape and duct tape, also feature reinforcements of woven cloth or glass strands, and typically are paired with rubber based adhesive systems.

## **Double Coated Tapes**

For a double coated tape, an adhesive is applied to both sides of a backing. The release liners are commonly paper and coated on both sides of the paper with silicone release agents creating a differential release. The pressure sensitive adhesive is coated on both sides of the carrier which is typically a polymeric film such as 0.5 mil polyester. The adhesive on each side of the carrier may be the same or different chemistries and may have the same or different coating thicknesses. The differential double coat is good for bonding substrates with differing hi-low surface energies. The double coated tape is typically lined with a silicone differential release liner.

Examples of double coated tapes include mounting, medical and membrane switch.

## **Adhesive Transfer Tapes or Unsupported Tape**

Adhesive Transfer Tapes, also known as unsupported PSA tapes, consist of release liners and adhesives. The release liners are commonly paper and coated on both sides of the paper with silicone release agents creating a differential release. Acrylic adhesives are commonly used in this application.

Examples of unsupported tapes are envelope sealing, graphic attachment and splicing.

## **BACKING MATERIAL**

A backing material, also referred to as facestock, carrier or substrate, is a thin, flexible material that can be coated with an adhesive. A substrate can be made of cloth, non-woven material, film, metal foil, foam, rubber, paper or laminate. These flexible materials offer a wide choice of performance and handling characteristics.

When selecting a backing material, consider the thickness, strength, conformability, color and the resistance to temperature, solvents, chemicals, moisture and abrasion.

### **Reinforced**

In addition to the backing and adhesive, these tapes include a reinforcement layer of woven or knitted cloth or glass strands parallel to the machine direction. Typical backings include polymeric films such as polyethylene and polyester. Rubber based adhesives are the most common but others can be used.

Examples of reinforced tapes are duct and filament.

# ADHESIVE TYPES

There are three main groups of adhesives used in PSA tapes; rubber, acrylic and silicone adhesive systems. The adhesive is coated on one or both sides of the backing material. When needing to bond to different energy surfaces, differential acrylic/rubber adhesives may be used. Each type of adhesive has different characteristics that affect production and end-user performance.

## 1. Rubber-Based Adhesives

Rubber-based pressure sensitive adhesive systems typically bond to a wide variety of substrates, including low surface energy materials and satisfy most adhesion requirements. Due to their low temperature range, poor UV and chemical resistance, they are best for indoor applications.

Rubber-based adhesives are divided into natural and synthetic rubber. **Natural rubber** typically offers the highest adhesion and shear properties, compared to acrylic adhesives. **Synthetic rubber** is broken down to three groups; **Hot-melt** has low temperature resistance and ages poorly, **Solvent rubber** has better temperature and aging performance but still poor UV resistance and the **Butyl rubber** offers excellent UV and aging resistance, but lower mechanical strength.

## 2. Acrylic Adhesives

Acrylic-based adhesive systems are more versatile and a little higher cost than rubber-based systems. Acrylic adhesives can either be **Water-based**, also referred to as **Emulsion** or **Dispersion**, or **Solvent-based**. Water based are slower drying compared to solvent-based systems, but generally solvent-based systems are generally better resistant to solvents, chemicals and water.

While rubber-based adhesives have a higher initial bond, the acrylic pressure sensitive adhesives go through a 24-hour cure cycle, allowing the bond to continue to improve over time. Pure acrylic, also known as standard acrylic, have a lower tack and less adhesion to low energy surfaces than modified acrylic or rubber adhesives. Modified acrylics typically have superior adhesion to a wider variety of surfaces.

## 3. Silicone Adhesives

Compared to acrylic and rubber adhesive, silicone is significantly more expensive. Silicone bonds to fewer substrates, but due to their excellent high temperature performance and chemical resistance, they are well suited for splicing tapes, polyimide tapes and medical applications, to name a few.

## Adhesive Characteristics

This chart is only a guideline of typical performance characteristics.  
Due to the variations in chemistry, adhesive testing is highly recommended.

Factors	Natural Rubber	Synthetic Rubber	Standard Acrylic	Modified Acrylic	Silicone
<b>Cost</b>	Economical	Economical	Medium cost	Medium to High cost	Most Expensive
<b>Surface energy</b>	Bonds to wide variety of surfaces, including LSE	Bonds to wide variety of surfaces, including LSE	Bonds to HSE	Bonds to wide variety of surfaces, including LSE	Bonds to fewer surfaces
<b>Initial tack and adhesion</b>	Excellent initial bond	Excellent to Good initial bond	Moderate initial bond	Moderate initial bond	Fair initial bond
<b>Peel strength/adhesion</b>	Excellent	Excellent	Moderate	Excellent	Moderate depends on type of surface adhered to
<b>Shear strength</b>	Excellent	Good to Excellent	Good to Excellent	Low	
<b>Removability vs Permanent</b>	Removable	Removable	Permanent	Various	Removable
<b>Aging resistance (does not yellow)</b>	Poor	Fair	Excellent	Good	Excellent
<b>Temperature range</b>	up to 200° F Short Term	up to 200° F Short Term	up to 450° F	up to 300° F	up to 600° F Excellent low temperature performance
<b>Temperature resistance</b>	Low	Low	Moderate to Excellent	Low to Moderate	Excellent
<b>Moisture resistance</b>	Excellent	Moderate	Excellent	Moderate	Excellent
<b>Chemical resistance</b>	Low	Low to Moderate	Excellent	Moderate	Excellent
<b>Solvent resistance</b>	Poor	Moderate	Moderate to Excellent	Poor to Moderate	Excellent
<b>Plasticizer resistance</b>	Poor	Poor	Excellent	Moderate	Excellent
<b>Oil resistance</b>	Poor	Poor	Excellent	Moderate	Excellent
<b>Ozone resistance</b>	Poor, Needs stabilizers	Poor, Needs stabilizers	Excellent	Moderate	
<b>UV resistance</b>	Poor, Needs stabilizers	Poor, Needs stabilizers	Good to Excellent	Moderate	Excellent
<b>Outgassing</b>	Good	Good	Good	Moderate	Good
<b>Food contact</b>	Moderate	Good			Good
<b>Skin contact</b>	Moderate	Moderate			Excellent
<b>Typical Color</b>	Amber	Amber	Transparency	Amber	Clear

## **PRIMER**

A primer is used to increase the bond of the adhesive to the backing. The use of a primer assists in keeping the adhesive on the backing when a tape is removed.

## **RELEASE LINER**

The release liner is the backbone of the pressure sensitive product that protects the adhesive until it is applied. It provides a supporting role as a vehicle for the adhesive during the coating, slitting and converting processes. Ultimately, the liner is disposed of by the end user

A liner is typically used for double-sided tapes, but is sometimes found on single-sided tapes as well. Siliconized paper is the main type of release liner. Siliconized film is also used in applications requiring greater flexibility and high tensile strength.

## **RELEASE COATING**

Silicone is applied to the backing and cured. This coating allows the tape to unwind from the roll. Without a release coating, the tape would adhere to its own backing, and would not unwind.