Understanding PSA's

Presented by

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Understanding PSA's

- What are Pressure Sensitive Adhesives?
- What Makes PSA's work?
- Tape Constructions
- Release Liners
- Adhesive Selection

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What Does Pressure Sensitive Adhesive (PSA) Mean?

PSA is a term used to designate a group of adhesive tapes in dry form that are permanently tacky and aggressive at room temperatures. These products will adhere to a wide variety of surfaces with only hand or machine pressure, without the aid of an activator.

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What makes PSA's Work?

Surface Contact: This is fundamental to adhesive performance. To maximize the contact to a substrate:

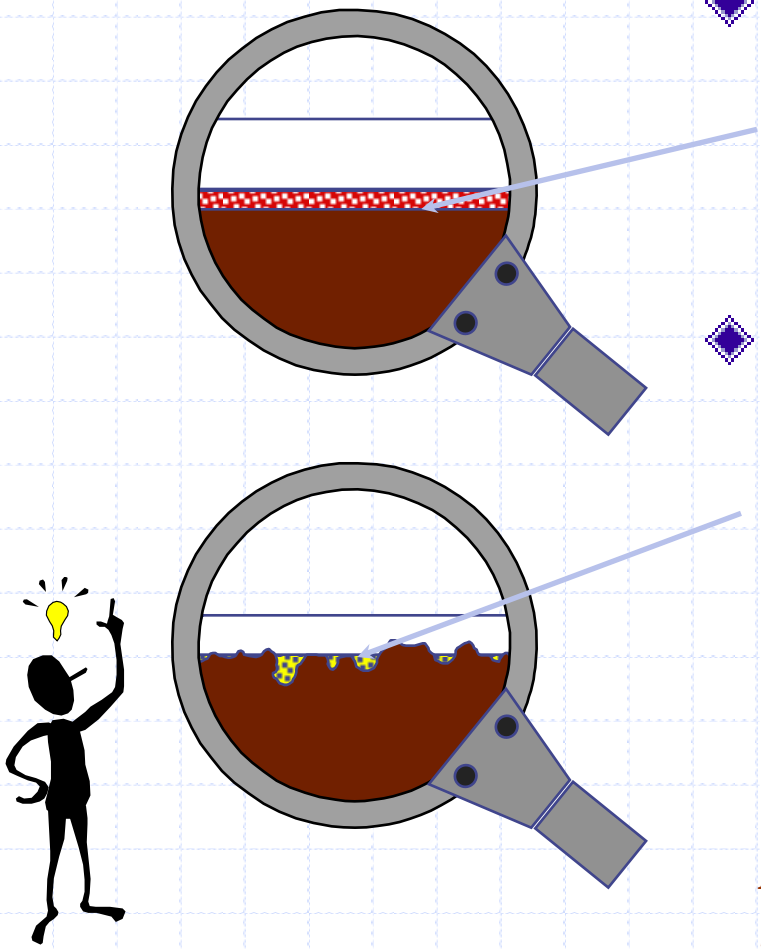
1) It must be dry, and free of contaminants.

2) Firm pressure must be applied to improve the contact of adhesive with the substrate.

3) Typically, time and temperature will increase contact and adhesion values.

Surface Contamination

Each of these situations can result in a poor bond

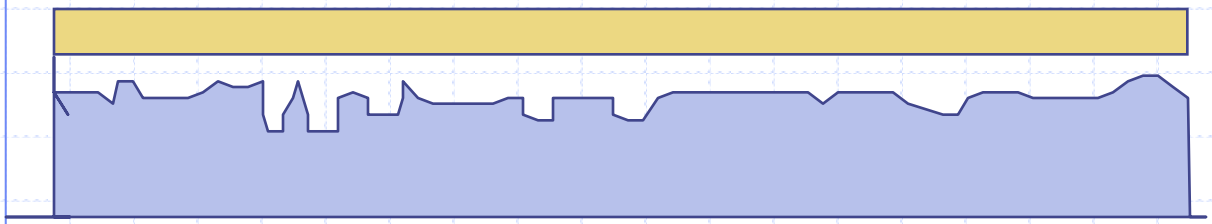


- **Grease, Moisture, Oil, Mold Release Chemicals**
  - Creates a barrier between adhesive and substrate
- **Sanding Dust, Particle Contamination**
  - Affects tackiness of adhesive
  - Reduces contact surface area

Always clean your substrates before applying a PSA!

Surface Contact:

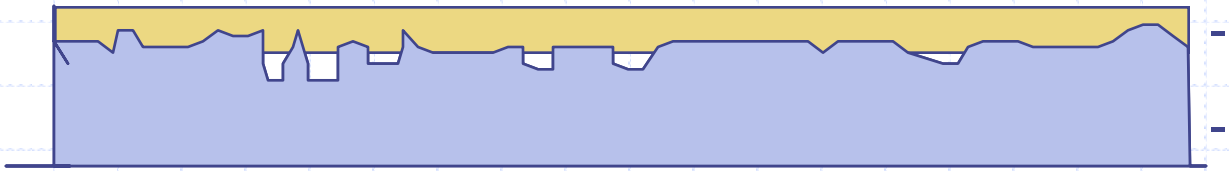
Initial (Minimal) Contact



-- Adhesive

-- Substrate

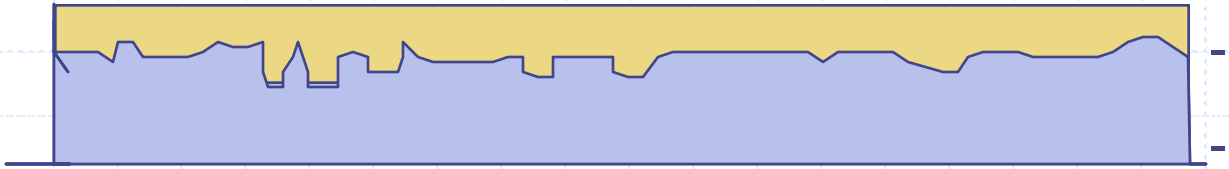
After Rubdown (More Contact)



-- Adhesive

-- Substrate

After Dwell Time (Excellent Contact)



-- Adhesive

-- Substrate

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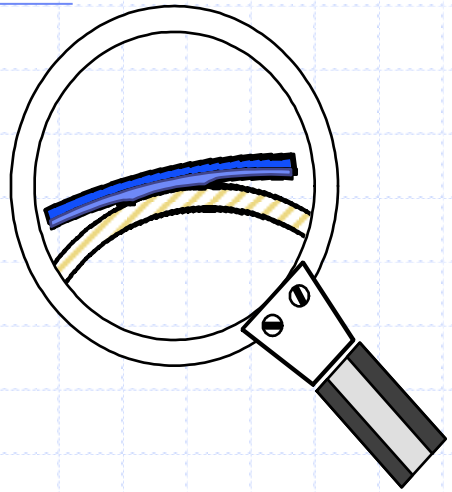
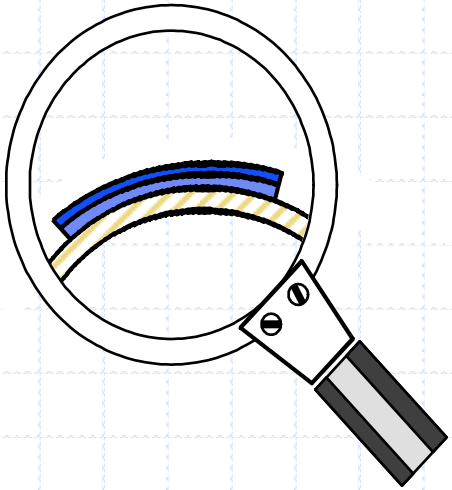
Surface Contour





Curved Surface combined with thin adhesive & a PET carrier (double-coated tape) may cause:

*** Internal stresses and**

*** Edge lift (Flagging)**

Curved Surface combined with thick adhesive & no carrier (transfer tape) may provide:

*** Maximum surface contact**

*** additional bond strength**

Adhesive Chemistry

- Rubber Adhesives--Adhesives made from natural or synthetic rubbers which are made tacky by mixing them with various compounds.
- Acrylic Adhesives--A combination of acrylic monomers and other compounds, formulated to create specific chemical structures which are tacky. Unlike rubber formulations, combining acrylic monomers creates a chemical change of the components.

Types of Pressure Sensitive Adhesives

Rubber Based Adhesives

- Excellent initial tack--ability to stick "quicker" than acrylics but are not as good for aging and weather resistance.
- Service temperature 30°F to 120°F (depending on applied load).
- Provides good bonds to low energy surfaces.

Acrylic Adhesives

- Generally good shear properties (holding power).
- Higher temperature resistance, service range -30°F to 300°F (depending on applied load).
- Excellent UV resistance which can attack and break down rubber-based PSA's.

Removability Vs. Reposition-ability

- **Removable**– The ability of a pressure sensitive adhesive product to be easily removed without leaving a residue. This characteristic is effected by the substrate, the length of time adhered, and the ambient conditions.
- **Reposition Ability**– The ability of a pressure sensitive adhesive product to be easily removed and repositioned onto the substrate in the short term. This same system will develop a permanent bond after a given period of time.

Peel vs. Shear

Peel

- Indicates the "adhesive" strength of a product.
- Values reported in lbs/inch of width based on peels from stainless steel.
- In general, Rubber-based adhesive provide higher peels than Acrylic PSAs.

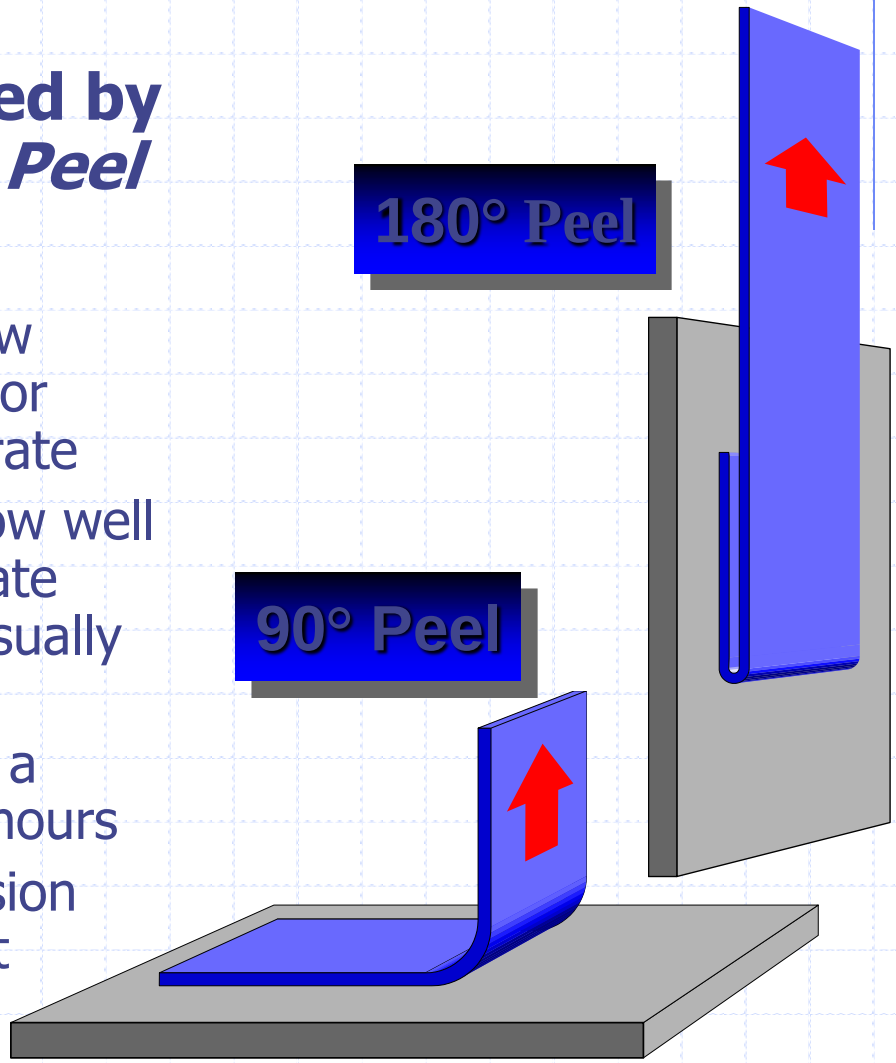
Shear

- Indicate the load-bearing or "cohesive" strength of a product.
- Shear values expressed in terms of time (minutes or hours) to failure at a given temperature.
- Acrylics tend to exhibit more shear strength than Rubber-based products.

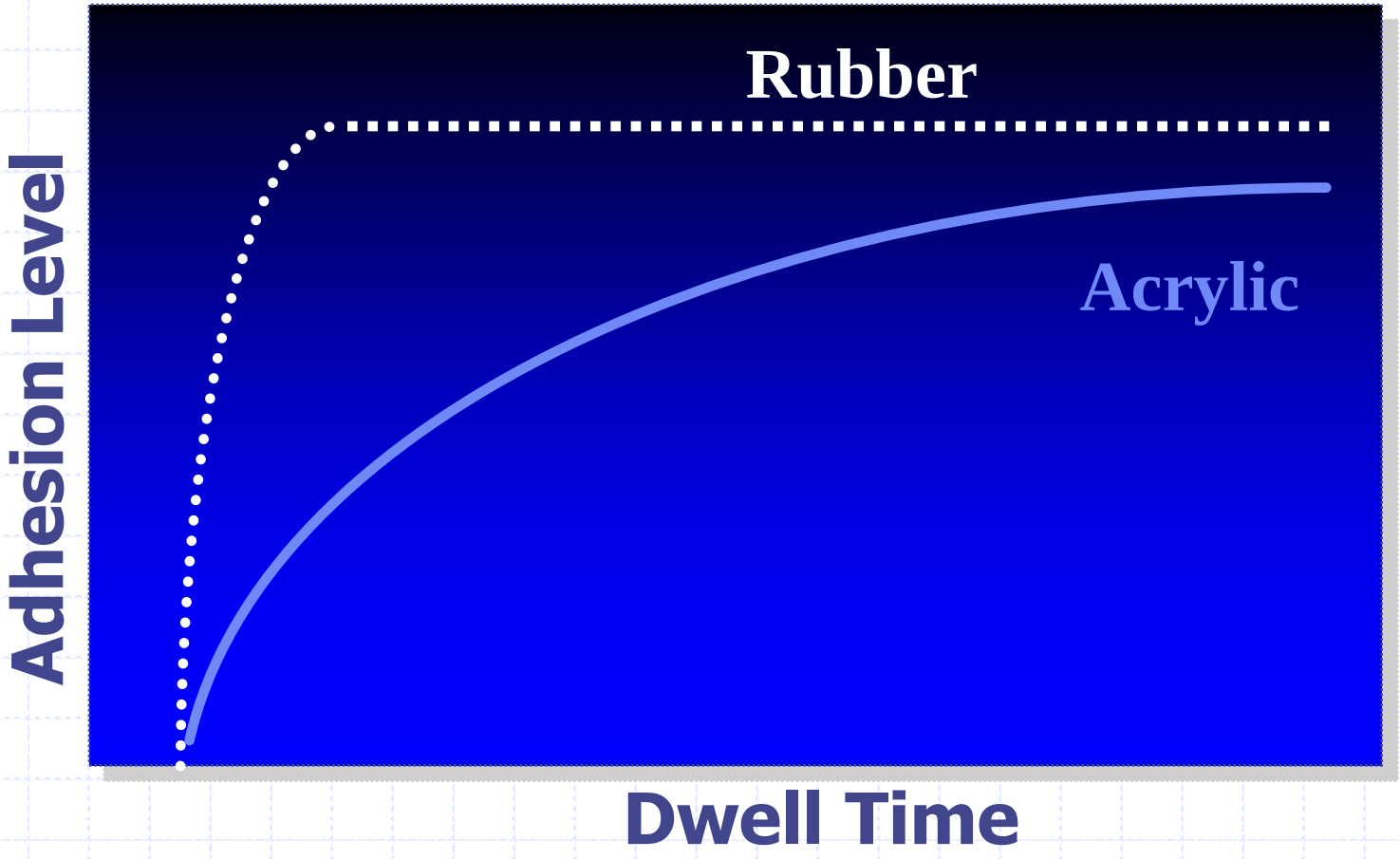
A general note: While modern adhesives can have both high peels & high shear, these characteristics tend to be inversely related.

"Peel Tests" measure Adhesion

- **Adhesion can be measured by a test method called the *Peel Test* *(PSTC 101)***
  - ***Peel Values*** then indicate how strongly the PSA has bonded, or adhered, to a particular substrate
  - ***Initial adhesion*** indicates how well a PSA has bonded to a substrate after a short period of time, usually seconds or minutes
  - ***Ultimate adhesion*** refers to a PSA's bond strength after 72 hours
  - Both initial and ultimate adhesion are measured by the Peel Test



The bond strength of Acrylic adhesives builds over time...



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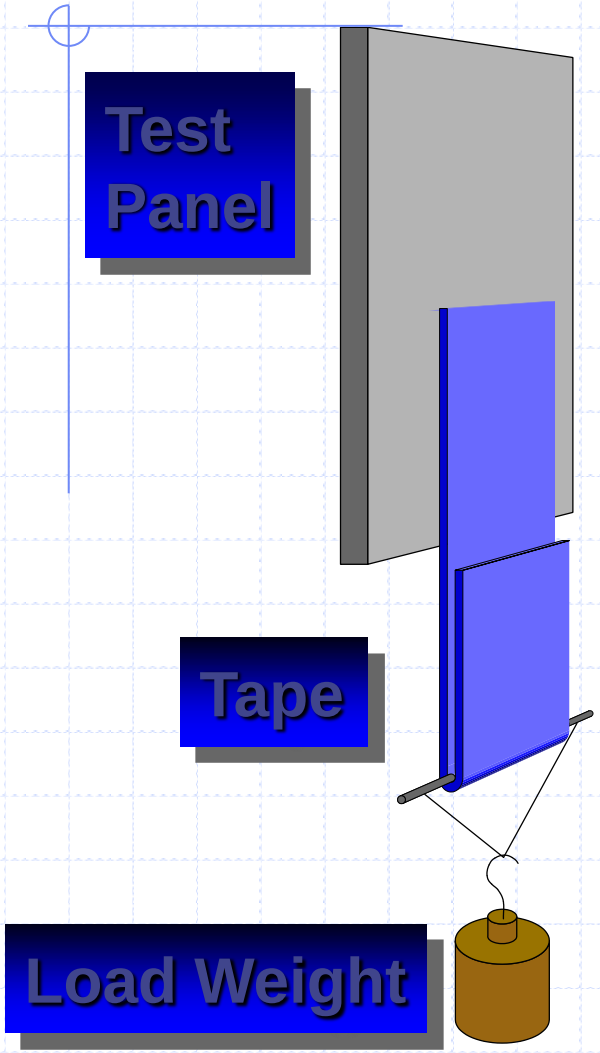
"Shear Tests" measure Cohesion (Internal Strength)



Cohesion can be measured by a test method called the *Shear Test (PSTC #107)*

- ***Shear Values*** then indicate the internal strength of an adhesive. Adhesives with higher shear values (which equates to stronger cohesion) will withstand exposure to higher temperatures.
- ***Units*** – Time expressed in minutes, hours or days.

Shear strength keeps sanding discs from flying off of the sanding tool.

De-bonding Mode or Mode of Failure:

- **Fails Adhesively**--A clean removal of the adhesive from the substrate; where no adhesive traces are evident.
- **Fails Cohesively**--Internal failure of the adhesive. The adhesive splits, leaving residue on both surfaces.

Adhesive Tape Constructions

- **Single Side Adhesives**--Adhesive coated on one side of a flexible carrier. Product may be supplied with a protective release liner on the adhesive side, or self wound (example: masking tape, duct tape, etc.).
- **Double Side Adhesive**--Adhesive coated on two sides of a suitable carrier. These products are supplied with some form of coated release liner.
- **Transfer Tapes**--Unsupported adhesive coated directly on a differentially coated release liner.

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Tape Components

- **Carrier**--A means of supporting and separating adhesive coatings. Also known as the web.
- **Release Liner**--Protective covering for the adhesive film to prevent "unwanted" adhesion and contamination of surface during shipping and handling. Release liners are silicone coated to provide a desired release characteristic. Liners may be plastic films, densified Kraft, polycoated Kraft, or "board".

Adhesive Tape Constructions

Transfer Adhesives (Unsupported)

--Adhesive
--Release Liner

- **Key word here is "unsupported", there is no carrier. There is nothing to hold the adhesive together except for it's own internal strength.**

Application Advantages: **Transfer adhesives work very well for applications where you need flexibility and stretch and for bonding to irregular surfaces. Examples might be to adhere sanding disks to tools where bond surface is not flat. Standard calipers available range from 1 to 5 mils.**

Tape Constructions--With Carriers

Single Side Adhesives

Double Side Adhesives

Carrier Types:

- Polyester Films
- Polypropylene Films
- Crepe Paper
- Tissue Paper
- Vinyl Films

Application Advantages: It facilitates secondary operations such as slitting & die cutting.

Silicone Coated Release Liners

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Typical Silicone Coated Release Liners

- 55 lb. Densified Kraft
- **60 lb. Densified Kraft**
- **60 lb. Polycoated**
- 74 lb. Polycoated
- **80 lb. Densified Kraft**
- 12 pt. Board
- **P – 1.5-mil Polyester Film**
- PET – 4.0-mil Polyester Film

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So What Does the lb. Mean?

- Lb. refers to the basis weight of the paper expresses per ream where….
- 1 ream of paper = 333.3 Sq. Yds.
- For a 60 lb. liner 333.3 Sq. Yds. will weigh 60 lbs.
- 12 pt. Board does not refer to either basis weight or caliper. It's a different measuring system entirely.
- 12 pt. Board in basis weight = 140 lb.

What about Polycoated Liners?

- For polycoated liners, the paper & the two sides coated with polyethylene are added together to get the total basis weight.
- Example: A 74 lb. polycoated liner would consist of a 50 lb. paper coated on each side with 12 lbs. of polyethylene.

60 lb. Liners

- **60 lb. Densified Kraft**--One of the more economical liners, it is suited for general purpose applications and rotary die cutting but not “kiss cutting”.
- **60 lb. Polycoated**--Better moisture resistance than densified Kraft.
- **Caliper** for 60 lb. liners is about 3.5 mils.

80 lb. Densified Kraft Liners

- **Heavier** version of the 60 lb. liner for improved processing.
- **Die Cutting** performance is improved.
- **Tear Resistance** is enhanced.
- **Caliper** for the 80 lb. liners is 4 to 5 mils.

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Plastic Liners

- **Thickness** of plastic liner is expressed in mils not basis weight.
- **Tear Resistance** is excellent.
- **Clarity** can be used with a printed paper to identify the manufacturer or abrasive grit.
- **Processing** especially high speed rotary die cutting is enhanced.
- **Cleanliness** means no paper dust produced by slitting or die cutting.

Adhesive Selection

Rules of Thumb:

- Let your surface be your guide.
- You get what you pay for.
- Match performance requirements to adhesive capabilities.
- Let your release liners work for you.
- Consult an Adhesive Tape Engineer!

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Points to Remember

- **Pressure-sensitive adhesives must have pressure to effect a bond.** ***Insufficient bonding pressure is the most common cause of adhesive tape failure.***

- **Surfaces to be bonded must be clean.** ***Any dirt, sanding dust, or oil on the substrate will prevent adhesive wet-out of the surface and will probably result in bond failure.***

- **Low application temperatures will impede the wet-out process.** ***The recommended temperature to apply PSA's is 65ºF-75ºF. This applies to both the adhesive and the substrate. Application temperatures less than 50ºF will cause bonding problems.***

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Points to Remember: *(cont.)*

- **Rough or irregular surfaces are tougher to wet out than smooth surfaces.** ***Therefore one of the following may be required for best bonds:***
  - ***1. More pressure***
  - ***2. Thicker mass of adhesive***
  - ***3. Softer adhesive***
  - ***4. Additional heat to soften adhesive and thus improve flow.***
- **High shear strength adhesives are better able to withstand the softening effects of high temperatures generated by sanding friction.** ***Simply put they flow less than softer low shear, high peel adhesives.***

Other Information Sources

- **PSTC Tape University**– Two day seminars conducted annually. PSA 101 is basic and PSA 102 is more advanced.
- **Reference Text**– Pressure Sensitive Adhesive Tapes by John Johnson Copyright © 2000 by the Pressure Sensitive Tape Council 2514 Stonebridge Lane, P. O. Box 609, Northbrook, Illinois 60065-0609.

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Thank You for Your Interest and Attention!
Questions?

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