TECHNICAL ASSISTANCE

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Version: 1
Approved: WEJ
Date: 07/2003

Tips and Procedures for Bonding Pressure Sensitive Tapes to Foams and Other Soft or Porous Materials

General Information:

Once a Pressure Sensitive Adhesive (PSA) product has been selected based on its properties matching the application requirements and compatibility with the substrates involved, the practical challenge of bonding the adhesive on a production scale must be addressed.

The best practice for bonding PSA to any material is a process that rolls the adhesive onto the substrate using firm pressure. The adhesive should be brought into contact with the substrate only at the point that the bond is being made. Allowing the adhesive to contact the substrate prior to the pressure point may lead to entrapped air due to the adhesive bonding prematurely. This often occurs when a sheet of adhesive is placed on a substrate and pressure is added later. Typically this occurs in hand applications or attempts to make the bond in a platen press.

Bonding Equipment:

Typical automated laminating equipment consists of a rubber-covered roller of moderate hardness and an opposing second roller of hard steel. It is also possible to use two rubber-covered rollers but one should be very firm.

In less automated arrangements it is possible to use a rubber covered roller and a firm plate or tabletop as the opposing surface. This method can also be used when the substrate is in sheet form and the adhesive is a continuous web.

More sophisticated laminating equipment may also have a means of introducing heat to the bonding process. This can take several forms and can influence the laminating procedure and even the product selection as will be discussed later. As an example, heat can be introduced through one of the two opposing rollers, by means of a heated platen located just prior to the laminating point or a radiant heat source that is focused onto the adhesive web.

Bonding Procedures:

There can be many bonding procedures used that are often dictated by the type of equipment, the type of material to be bonded and the construction of the PSA tape. The following are some basic examples that might be applied to fit a particular need or situation.

1.) Typically, the web of PSA is mounted on an unwind shaft so that it can be continuously unwound and introduced at the point of lamination. The tape may partially wrap around one of the laminating rolls with the protective liner against the roll and the adhesive facing out. The amount of wrap may vary depending upon the PSA construction or the distance the web must travel from the point of unwind. The amount of wrap may require adjusting to prevent wrinkles and allow a smooth lamination.

2.) In some cases where the substrate to be bonded is flexible, it may also partially wrap the opposing laminating roll to provide proper web tensioning.

3.) Tensions on the PSA web as well as the substrate web should be sufficient to allow the materials to be joined together without wrinkling or curling. Too much tension on a web can result in wrinkles or curl whereas too little tension may cause wrinkles. If either of these conditions occurs, adjustment of the web tension should be considered.

4.) Although maximum laminating pressure is desirable to achieve the most intimate contact of the adhesive and substrate, soft or compressible materials such as foam will often result in curling if the foam is totally compressed. A rule of thumb would be to compress the foam between 50-75% of its original thickness. Adjusting the pressure or gap between the laminating rolls will help avoid this problem. However, compressing the foam substrate as much as possible without causing curl should always be the goal.

5.) Although PSA products are designed to bond at normal room temperature (above 50º F), it is often advantageous to add heat during the laminating process in order to make the adhesive softer and more flowable. This is particularly useful when bonding to porous materials such as foams or cloths. The softer adhesive can be more easily forced into the open areas of the substrate thus providing more contact. Another benefit is that a softer adhesive may permit the use of less laminating pressure which could eliminate other potential problems such as curl.

6.) There are several ways that heat can be introduced into the laminating process as previously mentioned. The method or location where the heat is introduced can have a significant effect on processing speeds, an effect on the adhesive web and ultimately on the adhesive bond. Four methods of heat introduction and their effect are listed below:

a.) **Heat shoe or platen located just prior to the pressure rolls** --- There are several disadvantages associated with this method. The adhesive web must be passed over the heated platen with the adhesive up and the liner side down against the platen. As a result, the heat must be conducted through the liner in order to heat the adhesive sufficiently. Since the liner will absorb some of the heat first, a higher temperature is needed to raise the adhesive temperature to the desired level. The amount of extra heat will vary with the thickness and type of liner. Also, the liner must be able to withstand the heat without detrimental effects. For example, if a polyethylene coated liner is used, the temperature must be kept below the melting point of the polyethylene and enough heat may not reach the adhesive to be effective. Another factor is the distance the platen is located from the laminating rolls. If it is too far from the rolls, the adhesive may cool down too much to significantly assist in the bonding. If the heat is increased to account for this, it may detrimentally affect the liner. However, the good news is that with most PSA's even a slight increase in its temperature will be of benefit during bonding.

b.) **Heated laminating roll** ---This method provides heat immediately at the point of laminating pressure. The most critical concern with this method is the problem of getting the heat to transfer through the liner to the adhesive almost instantly. In order to insure the proper transfer of heat, the roll can be heated to a higher temperature which may not be possible due to the type liner on the PSA tape or the speed of the laminating process can be slowed in order to allow more time for the heat to penetrate the liner and reach the adhesive.

c.) **Radiant heating focused on the liner side of the PSA web** --- This method of introducing heat is similar to the first two described above in that the heat has to pass through the liner in order to reach the adhesive. The type and thickness liner will dictate how much heat can be introduced. One of the advantages of this method is that the web does not have to come in contact with the heat source. It is also important to position this radiant heat source as close to the point of lamination as possible so that the adhesive does not cool down prior to making the bond. Another advantage of a radiant source is that it generally can be mounted near the adhesive web but can be tilted or redirected away from the web when it is necessary to stop the lamination process. This avoids overheating the web while it is stationary.

d.) **Radiant heating focused directly onto the adhesive** --- Since with radiant heat, the heat source does not have to touch the web, it can be positioned to radiate directly onto the adhesive side. This eliminates the need for higher temperatures to compensate for the heat loss associated with penetrating the liner first. As a result, the type and thickness of the liner does not play as significant a roll as in the previously described methods. It is still important to position the radiant heat as close as possible to the point of lamination in order that the adhesive does not cool down.

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Bonding Tips and Problem Solving:

The following suggestions are approaches to consider if a problem is encountered.

1.) If the bond obtained is only marginal, such as no foam tear, try one of the following:
   a.) Raise the temperature 10-25º F.
   b.) Reduce the running speed by 25% or more.
   c.) Increase the laminating pressure slightly.
   d.) Raise the temperature and reduce the speed.

2.) If the substrate curls coming out of the lamination nip, reduce laminating pressure or adjust web tension.

3.) If a good bond is obtained with the first few yards of material but subsequent yardage has reduced bond strength, it may be because the heated roll or platen cannot maintain its temperature. The lamination speed may have to be reduced or the temperature increased.

4.) If the bond is adequate but the PSA web begins to distort prior to lamination, either reduce the heat or increase the running speed.

5.) If the bonded adhesive web is wrinkled or folded over, try adjusting the tension on the web and/or reduce laminating pressure.