



### ***Protecting PSA Release Liners from Heat and Humidity***

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Siliconised release liners play a critical role in pressure-sensitive adhesive (PSA) systems, protecting the adhesive during transport and storage and through various converting and assembly processes. To successfully provide this protective function in varying atmospheres, the release liner must be shielded from excessive heat and extended exposure to humidity.

If the release liner is unprotected, humidity will cause it to wrinkle and buckle, especially during the summer months. To anyone who has manufactured or used pressure-sensitive tapes with a silicone-coated paper release liner, cockling is an all too familiar sight.

Cockling can destroy the adhesive system and cause major problems in the production process. Converters and fabricators can choose to simply unwind and discard a couple wraps of PSA tape to reveal non-cockled product. However, this wasteful practice may only solve some, but not all, of the problems caused by excessive heat and humidity.

In order to protect customers' operations from the problems created by cockling liners, Adchem Corporation, a leading manufacturer of innovative, pressure-sensitive adhesive tape systems, provides customers with solutions to combat this summer-time phenomenon.

To understand the causes of cockling and the measures that can be taken to mitigate it, we must look at the entire life-cycle of the release liner, from the manufacture of the liner material to the creation of the pressure-sensitive adhesive system and through any printing and converting processes, until the final removal of the liner.

#### ***The Cause of Cockling***

Eighty-five percent of all PSA release liners used today are made from paper, composed of wood pulp, which is, by its very nature, a highly absorbent material. In high humidity environments, paper will absorb moisture from the atmosphere. As the paper swells, it expands in all three dimensions.

The problem is that the various components of the PSA system do not expand proportionately. As pressure-sensitive tape is more dimensionally stable than the release liner, expansion is limited in the two dimensions of the horizontal plane. Excess expansion of the release liner, therefore, results in the liner moving in the third dimension, separating away from the tape and the adhesive web.

Cockling is not only caused by humidity but also by fluctuations in temperature. Elevated temperatures can dry out and damage wood fibers, making release liners more vulnerable to subsequent increases in humidity. Condensation will occur during the cooling cycle that follows high temperature processes, such as heat lamination. If not carefully controlled, these temperature fluctuations can cause cockling.

### ***The Cost of Cockling***

Cockling causes waste. The wrinkles cause air pockets to form, allowing the adhesive to dry out prior to application. This means that the release liner fails to perform its principal function of protecting the adhesive.

Cockling causes creases in the first and second laminating processes, resulting in waste of not only the pressure-sensitive adhesive system, but also destruction of the substrate material. In addition, wrinkles and creases in the release liner, or premature release caused by cockling, can clog converting, die cutting and printing machinery.

Uneven adhesive performance caused by cockling can be particularly problematic for small die cut parts. Parts positioned at an area where the adhesive is compromised will have an inadequate adhesive bond. Another problem is that small kiss-cut parts are apt to be pulled off the release liner during the cutting operations, causing waste and potentially jamming up the process.

Many printing operations require that release liners exhibit “layflat” characteristics that prevent curling. Even minute amounts of cockling are therefore unacceptable for many graphics applications.

The prevention of cockling not only provides a significant cost savings, but also serves an aesthetic function as well. While in some applications, liners are removed during the converting and assembly procedures, in others, a release liner remains intact until removed by an end-user. In this case, the liner must satisfy the performance and appearance requirements of the end-user, which often means a release liner free of cockling. For example, cockled release liners are typically not acceptable for bandages and other medical products, because they give the appearance of poor quality.

### ***Material Selection***

The first step in combating cockling is the selection of material for the silicone coated release lines. Unfortunately, the types of liners that are most resistant to cockling are also the most expensive.

The lowest cost material, densified kraft paper (with a basis weight of 60 or 80 lbs.), is commonly used but highly susceptible to cockling.

The easiest way to improve dimensional stability is to seal up with poly-coating. There are several paper coatings which are used to alleviate cockling. Poly-coated liners have a layer of polyolefin (plastic) coated on both sides of the base paper. This plastic layer helps to encapsulate the paper and protect it from drawing in the moisture.

Another option is to use a higher basis weight material. Although 12-pt board is a paper based liner, the heavy basis weight (equivalent to a basis weight of 140 lbs.) and a layer of poly-coating on both sides virtually eliminates cockling.

Finally, plastic film liners are not as absorptive as paper, and are, therefore, not susceptible to cockling. Film is growing in popularity, but still represents only 15% of liners. Paradoxically, although film is effective in addressing humidity concerns in summer months, it introduces static electricity challenges during drier seasons.

### ***Manufacturing Process***

“To control cockling, it is important to maintain moisture stability during the entire lifecycle of the release liner, especially with kraft paper release liners,” according to Eric Bjork, technical team leader at Loparex, the world's largest commercial supplier of siliconised release papers and films.

Bjork emphasizes that “the quality and composition of the paper itself is critical to maintaining dimensional stability. You need to start with good-quality, uniform paper material with an appropriate mixture of softwood and hardwood pulp. The better the layflat, the more square, the more resilient the paper will be to humidity and temperature fluctuation.”

During each step in the manufacture of the release liner, and the creation of the pressure-sensitive adhesive system, it is necessary to minimize the amount of heat that is applied to the paper and to remoisturize it to mitigate drying and restore the original moisture level.

Testing paper moisture levels and the ambient humidity, and remoisturizing as necessary, are essential elements of Adchem’s quality control processes. We also carefully package our products to protect them from humidity during transport and storage.

### ***Storage and Handling***

For users of pressure-sensitive adhesives, a few simple storage and handling procedures will prevent cockling problems and minimize waste.

- Rolls of tape with paper liners should be stored in a cool dry environment.
- They should be protected from dirt, extreme temperatures and humidity, and damage.
- Plastic wrap around each roll, including both ends, will help to keep the moisture from getting to the paper.
- When a laminating job is complete, the remaining roll should be wrapped in plastic, even if it is still up on the machine.
- Prelaminated parts (foam sheets, pre-coated graphic arts mounting boards, etc.) should be protected from humidity by storing them in a controlled environment or by wrapping them in plastic.
- Any product already threaded through the laminator will be unprotected and may need to be discarded if it develops severe cockling prior to the next job.

By observing these procedures, you will protect the release liner, so that it can serve its function of protecting the performance and appearance of the entire adhesive system.

### **About Adchem Corporation**

Adchem, an ISO 9001 certified and A2LA accredited company, manufactures an innovative line of pressure-sensitive adhesive tape systems, including double-coated papers, films, tissues, foams and fabrics; transfer tapes; one-side coated products and other custom-coated specialty products. Our 100% solids adhesives, solvent and water based acrylics and rubber adhesives are used in a variety of industries, including automotive, construction, electronics, graphic arts, medical and general industrial tape applications.