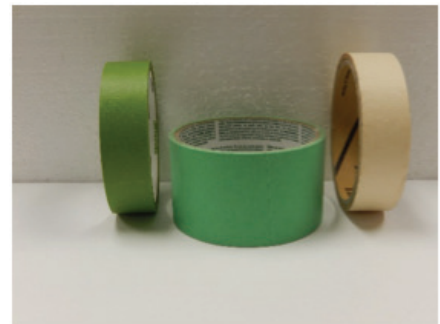


A pressure sensitive adhesive, (PSA), has the ability to stick to anything that it comes into contact with. Controlling adhesive adhesion until the adhesive is in its correct placement is the function of a release liner or release agent in the case of self-wound tapes. Release agents are usually low surface energy polymers that a PSA will not bond to. One of the most common polymers used as a release agent is silicone. Other types of polymers are also used as release agents, especially on self-wound tapes, such as vinyl carbamates, vinyl acrylic copolymers, fluoro-acrylates, modified polyurethanes and even modified starch chemistries. Release agents are usually a liquid, either solvent or water based, applied to the substrate then is dried and cured before coming in contact with the adhesive. Release agents can be formulated for different degrees of bond to the PSA depending on final product. An easy release is where the PSA removes from the release agent very smoothly with no sound. Modified release is where the bond of the PSA is a little higher to meet requirements of the final product. Tight release levels are used when a pressure sensitive media may encounter extremely small diameter rolls in either printing or die cutting or cutting small font graphics on a plotter cutter.

SELF-WOUND TAPES

Self-wound tapes are rolls of pressure sensitive product that upon use, one layer is pulled off the layer underneath it in the application process. Tapes are limited to one process, unwind and application usually in the same motion. Tapes are comprised of a substrate and pressure sensitive adhesive. Unseen is a layer of release agent on the surface of the substrate that allows the PSA to release smoothly from the substrate at application. Tape substrates can be a variety of products ranging from paper, plastics, fabrics and metals depending on their function. Paper substrate is commonly used as masking, application, and industrial tapes. Many base papers are porous requiring a primer to seal the surface before applying the release agent. Most paper tapes use non silicone release agents and are matched with the PSA to maximize application requirements. Various formulations of vinyl film are used in electrical tapes. Vinyl surface is smooth and sealed, offering an excellent surface for the release agent. However, a primer may still be needed to provide the release agent sufficient adhesion to the vinyl film. Polyolefins are used widely in self-wound packaging tapes. Their surface energy is fairly low and some may not use a release agent on the surface depending on the adhesive strength of the PSA. To improve shelf life of a polyolefin tape and a consistent release through the roll, a release agent can be applied. Metals such as those used in duct tapes, electronic and industrial applications offer a smooth, impervious surface and usually good bond but specific release agents may require a primer for improved adhesion. Generally, self-wound tapes use non silicone release agents with a host of formulations used depending on the tack and bond of the PSA and application requirements.



SHEET PRODUCTS AND DIGITAL MEDIA

Sheet and roll pressure sensitive products are designed to undergo multiple processes before its final application. These types of pressure sensitive products may be printed in multiple passes, laminated, die cut, or collated to produce a final product before application. To protect the PSA during these processes the typical sheet PSA product has three components, substrate, pressure sensitive adhesive and liner. In these products, release agent is applied to the liner component to keep the substrate free of any contamination allowing the substrate to be printed, hot stamped, or otherwise decorated. With the release agent being part of the liner component it does not effect the function of the finished product and winds up being thrown away at the time of application.

The typical release agent for these graphics pressure sensitive products are silicone polymers. Silicones are very efficient as a release agent for most PSA's and can easily be formulated to whatever release level is required for the final product. Silicone chemistry is readily available and has been the workhorse release agent for the history of these products. Silicone chemistry is available in solvent or water based with different catalysts allowing for a range of cure temperatures that can be adaptable for any liner substrate. Recent research concentrates on energy cured silicone release agents and more are becoming commercially available. These will allow very heat sensitive substrates to be considered for release liners and in the long run offer some economies in the production of release liners.

Just about any substrate can be a candidate for a release liner however papers, plastics and a combination of paper and plastics are the primary commercially available release liners.

PLASTICS

While a variety of plastics are candidates for a release liner (from their smooth impervious surface to their consistent thickness and transparency), polyester film (PET) is the primary plastic liner used in graphics products. Polyester's consistent thickness, hardness and ability to have a range of release levels makes them candidates for prime label decal liner. These same properties make thin gauge polyester an ideal liner for overlaminating films. An easy silicone release will result in a distortion free adhesive coating that is needed for high quality laminations. Polyester liners are also ideal for electronics because of the films very precise thickness control. Some polyolefins are also used as liners in medical and feminine hygiene applications.

PAPER

A wide variety of base papers are used in liner applications ranging from 40 pounds/ream glassine to 108 pounds/ream tag stock. The type of paper used for a liner is related to end use of the pressure sensitive product. The first difference between liners is color. Color is obtained by bleaching the paper fibers. Bleached paper is white while non-bleached paper is brown. Another term for non-bleached paper is Kraft paper, although that is also a specific paper manufacturing process also.

Thinner liners are usually densified and super calendered. That means the paper fibers were run between smooth calender rolls that will further pack and smooth the paper fibers resulting in a smoother harder paper than a regular machine finish. Densified super calendered base paper is ideal for roll label pressure sensitive media commonly printed by flexographic printing processes. The thin paper is well suited for the multiple small diameter rolls in a flexographic printing press and the hardened base paper is ideal for rotary die cutting. Any degree of release can then be applied to this base paper. For roll label applications, a medium release is required to prevent delamination during the printing process. This same base paper could be considered as a liner for a pressure sensitive overlaminating film. In this application an easy release is required.

Another method of sealing and smoothing the base paper surface is to apply a coating to one or both sides of the base paper. Many coatings have been tested over the years but the common commercially available paper coating is a clay coating. Clay and other additives are applied from a slurry to the surface of the base paper then dried. The smoothest clay coating is obtained by using the casting process. An extremely smooth roller evaporates the water and fuses the clay coating to the base paper producing a glossy smooth finish to the paper. Release agent can then be applied to this surface. A very common clay coated is the 78# clay coated liner typically used to produce sign vinyl. Clay coating provides the smooth uniform surface require for plotter cutting. Again a variety of release levels can be applied the smooth surface to meet the requirement of the plotter cutters.

Heavier base papers, in the area of 100 to 150 pounds/ream basis weight, can be used for specialized graphic applications. For pressure sensitive adhesive use a sealer may be applied to one surface before release agent application. In the static cling vinyl application, a seal coating or cast clay coating is applied to smooth the surface of the base paper. Depending on surface smoothness, a non-silicone release agent may be applied for use with ststic cling vinyl.

EXTRUDED LINERS (POLYCOATED PAPER)

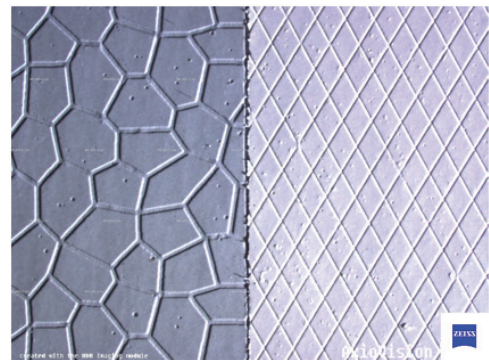
Another method of obtaining a smooth surface on a base paper is to extrude a plastic polymer on one or both sides of paper. In the extruding process, plastic polymer is melted and coated on the paper in a specific thickness then rapidly cooled to return to the solid state. The most common extruded polymers are the polyolefin family. Low, medium and high density polyethylene are used and each can provide specific properties to the final liner properties. Other thermoplastic polymers can be used in the extrusion process but polyolefins offer an economic advantage over most and the extrusion process is well established. Milk cartons and photographic paper are two other well-known commercial products using paper/ polyolefin extrusion.

Single sided extrusion liners can complete with super calendered densified Kraft in the overlamine and roll label applications. In these applications the base paper can range from 30 to 60 pounds/ream basis weight and be extruded with 12 to 25 pounds/ream thermoplastic polymer. For an overlay application a polyolefin is usually sufficient. For roll label media, polypropylene should be considered for increased hardness and improved rotary die cutting. Release agent is then applied in the appropriate release level to meet application requirements.

Double sided extrusion liners have a thermoplastic polymer, polyolefins being the most common, on both sides of the base paper. Thickness of the extrusion can vary between 12 to 25 pound/ream of polymer. Various weights of base paper can be used but one of the most common is a 65 to 70 pounds/ream. When extruding both sides with a polyolefin, the common 90# stay flat sheet liner is the result. Besides smoothness on the release side of the liner the extrusion seals the liner from ambient moisture that could cause the base paper to swell and subsequently curl. Staying flat is critical for sheet processing, especially when using screen and offset printing processes. Stay flat liners are also beneficial to digital printers in keeping the edges of the media roll curl free and preventing head strikes and jams while printing. In summary, the release level can be formulated to meet the requirements of the final product.

AIR EGRESS LINERS

Recent developments in the polycoated stay flat liner family is the air egress liner. These liners have micro embossing in the extruded component on the release side of the liner. These micro embossing patterns produce small channels in the PSA. Upon application of the adhesive, these small channels give air normally trapped between the adhesive and application substrate an avenue of escape. The photomicrograph to the left shows two typical patterns. The left pattern is random while the right is a cross hatch diagonal pattern. Both patterns are magnified to 12X. Micro embossing the adhesive ultimately allows large format graphics to be applied bubble free without the use of wetting or application fluids. These liners are designed for large format graphics and have some limitations of use. If you have any questions concerning the use of air egress liners in your applications contact your General Formulations Customer Service Representative. Know your legal limitations before using media with air egress liners.



Release agents and liners are varied, complex, extremely technical, and widespread in their types of composition and manufacture. The above list are some of the common liners you may encounter during a day of working with pressure sensitive tapes and media. There is not one ultimate release agent/ liner that can be used in every application. When needing a pressure sensitive tape or media product to meet an application, the liner plays as an important role in the selection of your product as the substrate and adhesive. When you have special liner requirements contact your General Formulations Customer Service Representative by phone at 800 253-3664 or through the website: www.generalformulations.com. Your customer service representative is available under Contact Us/Customer Service Team.