

ADDRESSING SHELF LIFE QUESTIONS FOR PRESSURE SENSITIVE ADHESIVES

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Why Use a Pressure Sensitive Adhesive?

Pressure sensitive adhesive (PSA) tapes (adhesive transfer tapes and double coated tapes) are a popular choice for many customers faced with a bonding challenges. Easy to use, flexible in design, and offering adhesion to many types of surfaces, PSAs have a long history of use in markets such as Electronics, Automotive, Appliance, Aerospace, Graphics, Print and Print Finishing, Web Processing and Construction. Furthermore, PSAs are often very durable and can even be known to outlive the applications for which they are used. For all their use, many questions remain about their shelf life; specifically, why do different PSAs have different shelf lives, what are the contributing factors to shelf life, and what happens if a product is used past its shelf life?

Shelf Life:

PSAs have a shelf life to help ensure usability and adhesive performance. Over time, some adhesives can become dry, brittle and lose their original performance properties. Although this occurs over time, it is helpful to have a date at which point the adhesive should no longer be used. In other cases, rolls of pressure sensitive adhesive tapes can deform, ooze, pick and otherwise be difficult to apply, despite retaining good performance relative to their stated performance levels. In this case,

a shelf life is helpful for providing a guideline for the date after which the product is unlikely to be easy to use.

In both cases, it is important to note that a product's shelf life does not offer commentary relative to its application life, or durability for a specific application based on its use and exposure conditions. Generally, once a pressure sensitive adhesive tape is unwound and successfully attached to one or more surfaces, its stability greatly increases and is less susceptible to usability and performance issues. Shelf life is then determined by the inherent properties of the adhesive chemistry in use, environmental conditions (such as temperature and humidity during storage) and the specific liner used in the product construction. We will explore each of these factors in greater detail below.

What Factors Impact Shelf Life?

A number of factors impact the length of a double-sided tape's shelf life, including the type of adhesive, storage temperature, humidity and handling conditions. We will examine each in turn.

Rubber-based PSA tapes

Rubber-based PSA tapes are commonly used in short-term applications, such as masking and packaging. These tapes are sensitive to oxygen, heat, and ultraviolet (UV) exposure, as they can

oxidize, losing adhesive performance and becoming dry and brittle. Synthetic rubber-based tapes tend to be less sensitive to environmental exposure than those made with natural rubber, therefore, more forgiving in storage conditions.

Silicone-based PSA tapes

Silicone-based PSA tapes are frequently used when either bonding to silicone substrates or when high-temperature resistance is required [300°F - 500°F (149°C - 260°C)]. Silicone-based tapes have a relatively short shelf life due to the interaction between the adhesive and the release liner chemistry. As silicone adhesive ages, the strength of the bond between the adhesive and liner increases, making it difficult to separate.

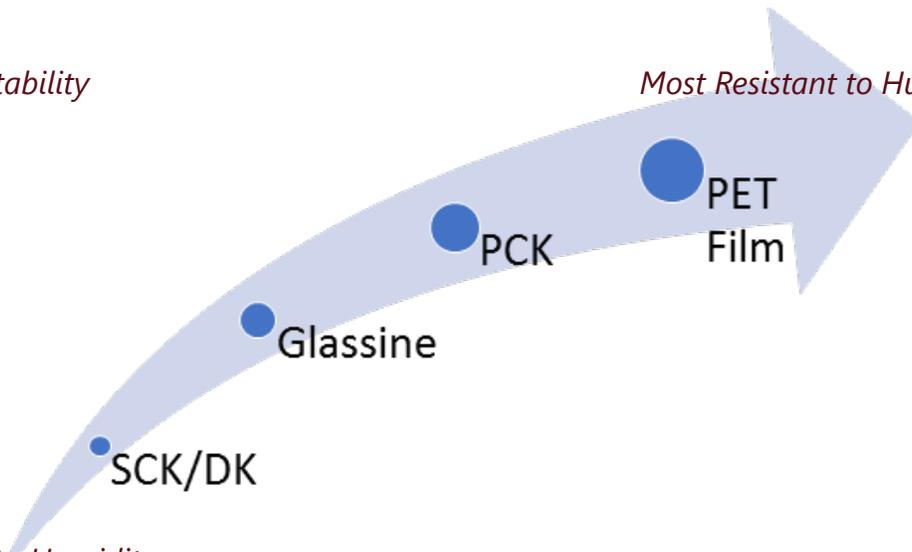
Acrylic-based PSA tapes

Known for its exceptional durability, UV stability, and long life, the acrylic adhesive chemistry allows tapes to work well in a wide variety of applications without the susceptibility to the same chemical interaction that silicone chemistry has with liners.

Pure unmodified acrylic adhesives, which do not contain an additive known as a tackifier to increase adhesion, tend to exhibit longer shelf life versus modified acrylic adhesives that do contain tackifiers. Tackifiers, although useful for increasing adhesion levels,

Moisture Stability

Most Resistant to Humidity



Least Resistant to Humidity

often contribute to the adhesive drying, which limits the shelf life. In addition, tackifiers can soften an adhesive which increases the likelihood of experiencing storage issues, such as, edge picking and edge ooze.

Impact of Liner on Shelf Life:

Liner selection can directly impact a PSA's usability and performance. Basic paper liners, such as Super Calendered Kraft (SCK) and Densified Kraft (DK), are often very susceptible to moisture, which absorbs into the paper and can cause the paper to expand and buckle. Such liner expansion can cause issues for usability of PSA tapes and can shorten its usable life. Moisture-related issues can be prevented by controlling the storage and application environment humidity. For maximum effectiveness, tapes should be stored in a moisture resistant bag along with a desiccant (e.g., silica gel).

In addition, liner thickness can also have a direct impact on usability. When comparing liner thickness, thinner caliper liners often exhibit a greater tendency to deform than thicker liners. Thicker liners tend to provide easier release over time and provide lower levels of liner tear as well as improved dimensional stability. Thicker liners can also provide more separation between adhesive layers, reducing the tendency of layers to bond together caused when adhesive flows out the edge of a roll.

Checking for Signs of Shelf Life Expiration

To ensure optimal performance of a pressure sensitive adhesive, it is wise to consider checking for signs of shelf life expiration before starting lamination or converting. Ask the following questions:

- Is the roll deformed?
- Does the tape unwind easily?
- Does the liner release cleanly?

Using the tape beyond the shelf life does not guarantee failure, but is not generally recommended for optimal results. It is recommended to consider the requirements of the application and contact the manufacturer if there are questions.

Impact of Storage and Handling on Shelf Life

Proper storage and handling can lead to fewer usability issues and maximize

usability over the recommended shelf life. Proper storage and handling recommendations include:

- Storage conditions of 60°F - 80°F (15°C - 26°C) and relative humidity (RH) levels between 40% and 60%
- Minimize impacts to the edges of a roll when unloading from protective packaging
- Store unused rolls in the packaging they were shipped in, and storing in a vertical position with the end plugs and plastic wrap in place

Closing

In summary, shelf life for PSA tapes revolves around the ability to put the product into use. Always check the product date page for technical information regarding shelf life and contact the manufacturer around any specific questions.