

FUNDAMENTALS OF FLUOROSILICONE LINERS

Richard Schmidt, Senior Chemist Loparex Willowbrook, IL.

Introduction:

Fluorosilicone release liners are primarily used in conjunction with silicone pressure sensitive adhesives (PSA's). With the fluorosilicone coating and the silicone PSA being reactive, maintaining a stable release is much more difficult compared with a silicone coating and an acrylic/rubber based adhesive. This paper will review general fluorosilicone formulation options, silicone PSA adhesive chemistries, adhesive processing, adhesive application methods, and how each of these variables plays a role in the release characteristics of the fluorosilicone liner.

Fluorosilicone Chemistry:

The majority of fluorosilicone release coatings are solvent diluted due to the higher molecular weight polymer. There are a few 100% solids fluorosilicone release coatings, but these make up a very small percentage of the market. Both of these systems utilize platinum cure chemistry. This limitation provides formulation challenges for creating release liners that meet the desired target release range compared with standard silicone release chemistry options. They typically require a higher cure temperature compared with silicone coatings.

Coating Type	Diluent	Cure Mechanism			
		Platinum	Tin	Rhodium	UV/EB
Fluorosilicone	Solvent	X			
Fluorosilicone	100% Solids	X			
Silicone	Solvent	X	X	X	
Silicone	100% Solids	X		X	X
Silicone	Water	X	X		

Minimal adjustments can be made to the fluorosilicone release coating because they are typically two component systems (polymer and crosslinker); therefore it is very critical to maintain tight process controls to minimize any variation. The same holds true for the silicone PSA's because any change would most likely effect the release characteristics.

General Constructions and Release Characteristics

Typical Constructions:

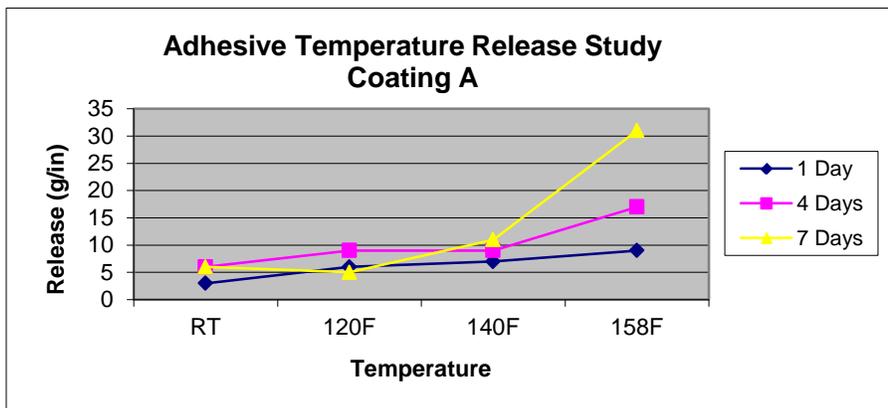
One side coated polyester

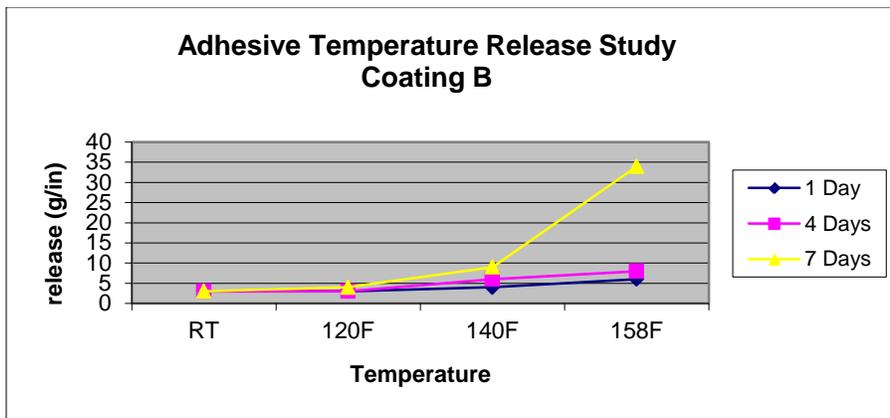
Two side coated polyester (same coating)

Two side coated polyester (differential)

The desired release criterion for a fluorosilicone liner is typically easy to very easy. The aging characteristics of the liner in both its raw state and combined state play a role in the final release. As the raw liner ages, releases tend to become easier and have more stable aging characteristics. The laminated materials will age up with time. Understanding and controlling these variables to a usable level can be a challenge depending on the adhesive and adhesive processing.

Below is an example of how two different coatings age up with temperature over time:





Typical Desired Ranges:

Release Test Parameters: 180 deg at 12 in/min

Room Temperature: Very Easy (under 10g/in) to Easy (10– 30g/in)

Heat Aged at 70C for 7 days: Very Easy (under 25 g/in) Easy (under 50g/in) Medium (under 100g/in)

Silicone PSA cure types:

Benzoyl Peroxide (BPO)

Platinum (Pt)

Typical release variables with BPO cured silicone adhesives:

- The greater the percentage of BPO the greater the release
- Requires a 2 stage oven:
- Stage 1: Low temperature for solvent removal to prevent premature activation of BPO
- Stage 2: High temperature to cure BPO
- Casting the adhesive to the liner will yield moderately higher release values compared to laminating

Typical release variables with Platinum cured silicone adhesives:

- Release is determined by actual adhesive formula and application method (adding more platinum tends to speed up the cure rate with little effect to release), but by having the same cure mechanism as the fluorosilicone coating the release tends to be higher heat aged than BPO cured adhesives.
- Lamination to a fluorosilicone liner can achieve easy releases while casting the adhesive to the liner will be much tighter and tend to age up more.

There are a limited number of silicone PSA suppliers with each having a handful of different products. Each of the adhesives has specific characteristics for a designed end use. The adhesives can be modified for more tack or cohesive strength.

Markets and Applications:

Silicone PSA's are typically used for higher performance where a wide operation temperature range and or environmental exposure is involved.

Industrial:

- Die cut (automotive, electronic)
- Tapes
- Miscellaneous

Medical

- Die cut
- Tapes

Economics:

Fluorosilicone liners are much more expensive than silicone liners and do not have the wide range of formulation options compared with traditional silicones. Matching up the adhesive and adhesive processing with the liner is critical in achieving desired results. One liner will not give the same results with all silicone adhesive offerings. Future developments will be directed to optimizing liner stability and tailoring the product for the application.