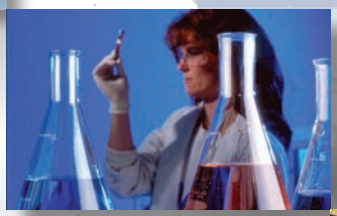
Pressure Sensitive
Solutions

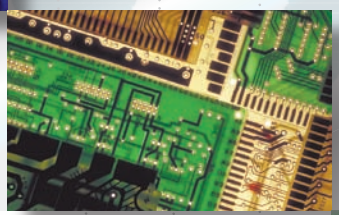
DOW CORNING

Product Selection and Application Guide

Dow Corning® brand High-Performance Silicone PSAs









Pressure Sensitive Adhesives from Dow Corning

Dow Corning offers you a fully integrated, fully supported product line for use in the manufacture of high-performance adhesive tapes and components. The silicone pressure sensitive adhesives (PSAs) and related materials described in this guide are available globally and are appropriate for use worldwide.

Dow Corning's global pressure sensitive adhesive product line consists of:

***Dow Corning*® brand silicone PSAs** – polydimethylsiloxane gums and resins dispersed in xylene or a blend of xylene and toluene. Two cure systems are available – platinum and peroxide.

***Dow Corning*® brand silicone primers** – compatible primers used to increase anchorage to difficult substrates.

***Syl-Off*® Q2-7785 Release Coating** – a solvent-based fluorosilicone release coating used in the production of liners, tapes and films for the release of industrial-grade silicone PSAs. Dow Corning silicone PSAs may be either wet cast or dry laminated to the coated liner.

Dow Corning can also provide you with other high-performance materials used in the manufacture of pressure sensitive adhesive tapes and components, such as liquid silicone rubbers and adhesion promoters. For more information, contact your Dow Corning representative, call one of the key locations listed on the back of this guide or visit www.dowcorning.com.

How to Select the Best Silicone PSA for Your Application

Selecting the best silicone PSA for your application can be a complex undertaking. Substrate requirements, equipment limitations, performance demands for tack, adhesion and cohesive strength, and the need for release all enter into the picture. This guide will help you simplify the selection process.

Begin with the PSA Selection Flow Chart. This will tell you which adhesives in Dow Corning's global silicone PSA line meet your basic application and processing requirements.

Then consult Tables 1 and 2 for more in-depth information. Table 1 will help you decide whether a peroxide- vs. platinum-cure silicone PSA is better for your needs. Table 2, supported by Figures 1-3, will help you determine which product best meets your requirements for tack, adhesion and high-temperature hold.

The section on "Processing and Curing Considerations" provides basic "how to use" information and discusses factors that can modify a material's performance profile.

The pressure sensitive adhesives in this guide offer the following high-performance silicone capabilities:

- **Ability to withstand exposure to extreme temperatures**
- **Adhesion to low-energy surfaces such as silicone or *Teflon*®**
- **Conformability**
- **Chemical, UV and weather resistance**

With silicone PSAs from Dow Corning, there are many ways to achieve the exact balance of performance properties your application requires. If none of the materials in this guide appear to meet your needs, contact your Dow Corning technical representative for additional suggestions.

Silicone PSA Selection Flow Chart

Platinum-cure material indicated in teal; peroxide-cure materials in black.

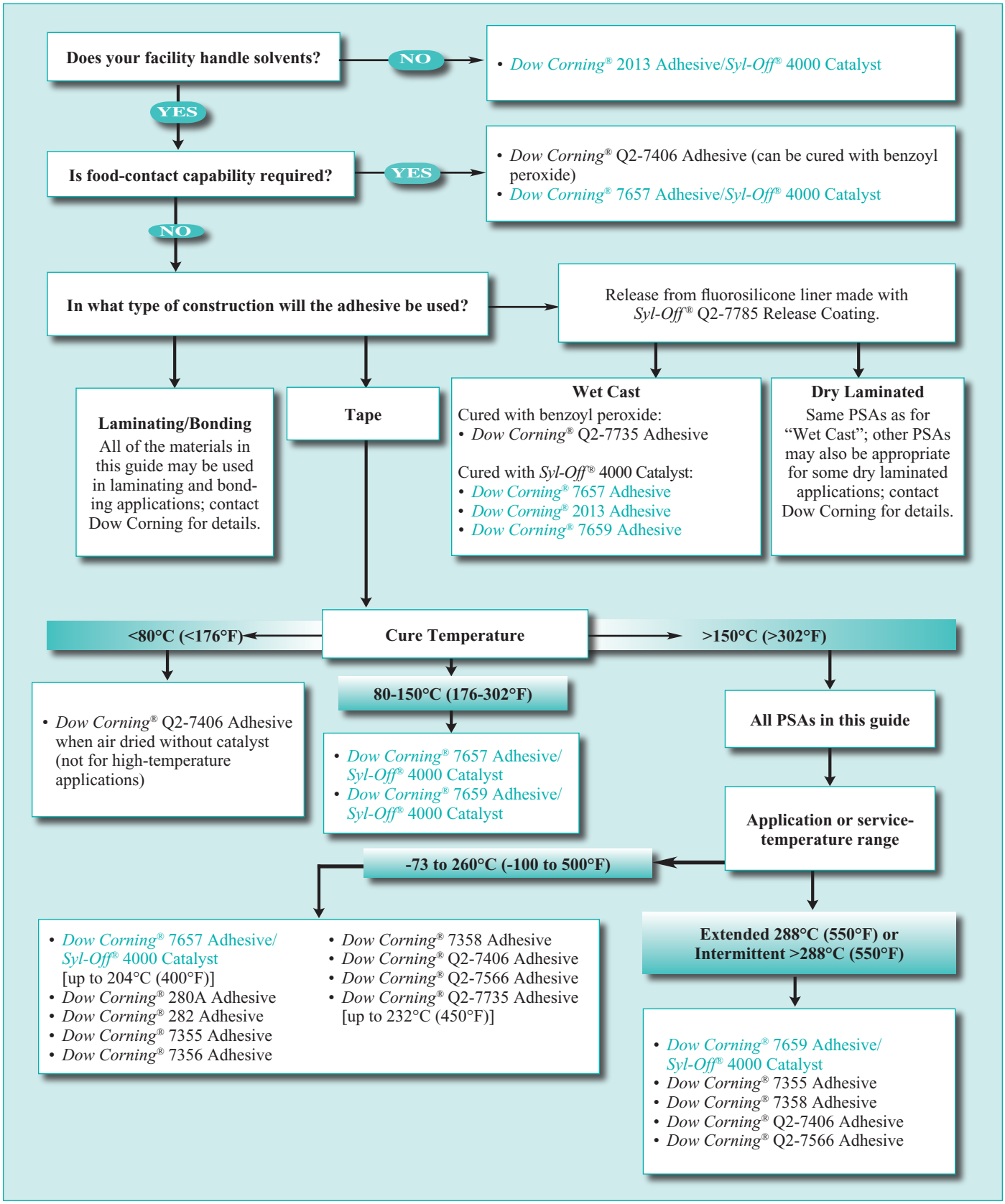


Table 1. Peroxide- vs. Platinum-Cure PSAs

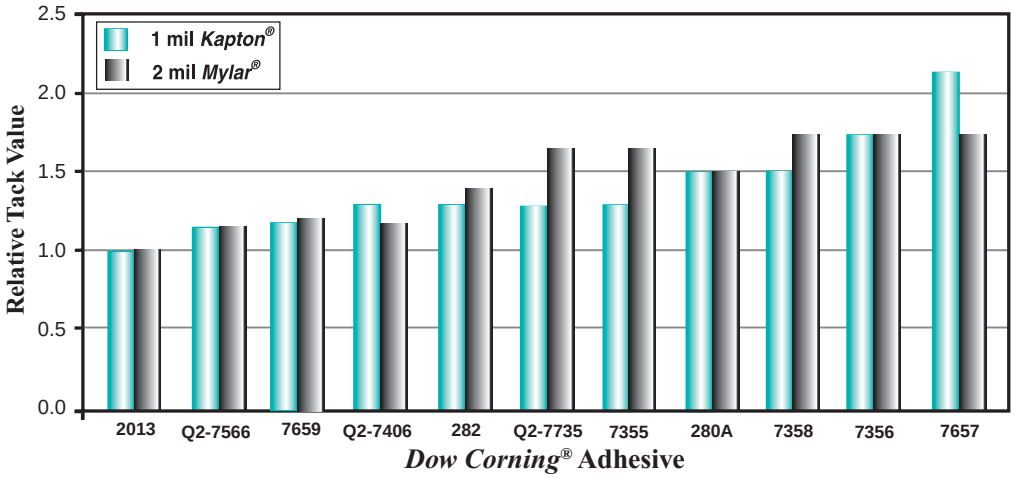
	Platinum-Cure	Peroxide-Cure
***Dow Corning*® brand Silicone PSAs**	2013 Adhesive (with *Syl-Off*® 4000 Catalyst) 7657 Adhesive (with *Syl-Off*® 4000 Catalyst) 7659 Adhesive (with *Syl-Off*® 4000 Catalyst)	280A Adhesive 282 Adhesive 7355 Adhesive 7356 Adhesive 7358 Adhesive Q2-7406 Adhesive Q2-7566 Adhesive Q2-7735 Adhesive
Components	Two-part system: silicone resin, crosslinker and polymer dispersed in solvent + platinum catalyst; catalyst required; 2013 Adhesive does not contain solvent.	One-part system: silicone resin and polymer dispersed in solvent; used with a peroxide curing agent.
Bath life	Generally 24 hours or less at 21°C (70°F)	Extended bath life
Cure Temperature and Oven Requirements	Can be cured at temperatures as low as 80°C (176°F) in a single-zone oven.	For tape constructions, cure temperatures >150°C (302°F) are generally required; cure is a two-step process that requires a multi-zone oven.
Benefits	Fast, low-temperature cure; may be used on temperature-sensitive substrates.	Robust cure system; catalyst resistant to poisoning. Adhesive properties may be modified by manipulating peroxide levels and oven conditions.
Drawbacks	Platinum catalyst is subject to contamination by peroxides and other materials.	Failure to remove solvent can result in bubbling, low adhesion, low cohesive strength. Failure to adequately degrade the peroxide can result in "snow" crystals, instability in high-temperature applications.

Table 2. Product Descriptions, Typical Performance Properties

Dow Corning® brand Product	Cure System	Features/Benefits	Typical Applications	High-Temp. Hold/Shear,[1] °C (°F) (Figure 3)
2013 Adhesive/ *Syl-Off*® 4000 Catalyst	Platinum	Solvent-free	Adhesive tapes, labels and transfer films; bonding low-energy substrates; high- and low-temperature labeling applications	260 (500)
7657 Adhesive/ *Syl-Off*® 4000 Catalyst	Platinum	Low-temperature cure, as low as 80°C (176°F); high tack and adhesion; meets FDA requirements for certain food-contact applications[2]	Temperature-sensitive substrates; transfer tapes and labels; recommended for use with release liner coated with *Syl-Off*® Q2-7785 Release Coating	204 (400)
7659 Adhesive/ *Syl-Off*® 4000 Catalyst	Platinum	Retains adhesion at high temperatures with minimum silicone left on the surface after tape removal; low cure temperatures	Lead-free solder masking and flexible substrates such as PTFE or polyimide; recommended for use with release liner coated with *Syl-Off*® Q2-7785 Release Coating	204 (400)
280A Adhesive	Peroxide	Good tack	Masking and plating tapes	260 (500)
282 Adhesive	Peroxide	Good adhesion	Masking and plating tapes	260 (500)
7355 Adhesive	Peroxide	High adhesion; good high-temperature performance; low silicone volatiles	Masking, plating and splicing tapes	260 (500)
7356 Adhesive	Peroxide	Balanced tack and adhesion; good high-temperature performance; low silicone volatiles	High-temperature masking, plating, electrical, plasma flame spray	260 (500)
7358 Adhesive	Peroxide	High tack; good high-temperature performance; low silicone volatiles	Electrical, plasma/flame-spray and high-temperature masking tapes	260 (500)
Q2-7406 Adhesive	Peroxide	General purpose adhesive with excellent high-temperature properties; meets FDA requirements for certain food-contact applications[2] and low silicone volatiles	Splicing and plating tapes	288 (550)
Q2-7566 Adhesive	Peroxide	General purpose adhesive with excellent high-temperature properties	Electrical tapes and other very high-temperature tapes	288 (550)
Q2-7735 Adhesive	Peroxide	Combines high tack and good adhesion	Recommended for use with release liner coated with *Syl-Off*® Q2-7785 Release Coating; transfer films and labels; masking, plating, splicing and electrical tapes	232 (450)

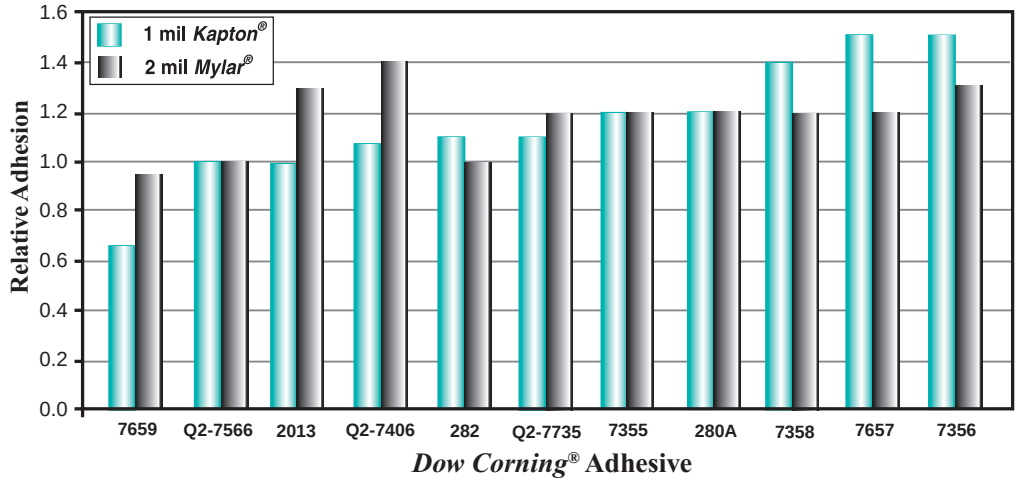
[1] 5 days, 1000 grams.
[2] Contact your Dow Corning representative for food contact information.

Figure 1. *Polyken*® Probe Tack



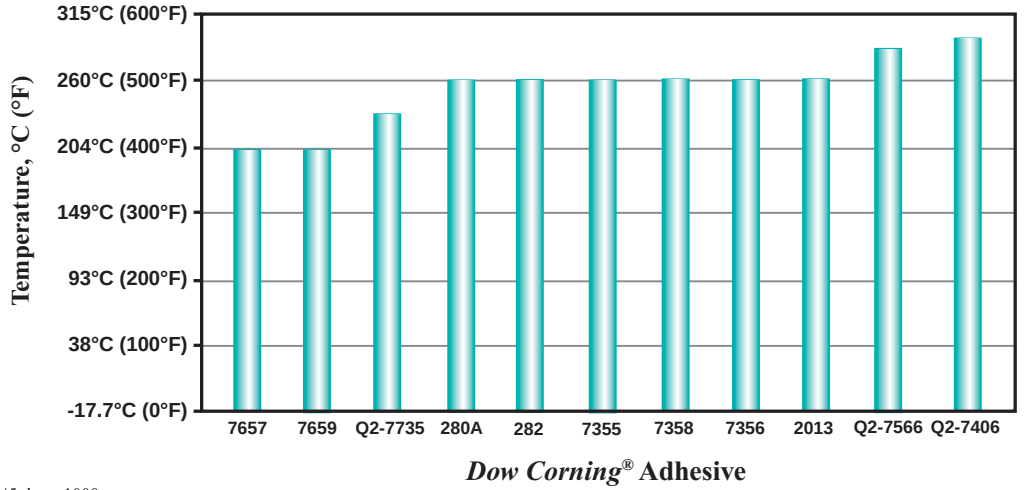
Polyken Probe Tack values are expected to be in the range of 600-1300 g for a 1-mil substrate and 800-1500 g for a 2-mil substrate.

Figure 2. Adhesion



Adhesion values are expected to be in the range of 30-45 oz/in (850-1290 g/in) for a 1-mil substrate and 45-65 oz/in (1290-1850 g/in) for a 2-mil substrate.

Figure 3. Comparative High-Temperature Hold (Cohesive Strength)[1]



[1]5 days, 1000 grams.

Processing and Curing Considerations

Silicone PSAs from Dow Corning can be applied to backing materials as supplied using conventional tape coating equipment. However, they are most often diluted with toluene, xylene or other nonpolar solvents to achieve a coatable viscosity. Coat weight control is critical for consistent performance.

In addition, peroxide-cure silicone PSAs from Dow Corning may be blended with other dimethyl-type silicone PSAs to modify the performance of the cured coating.

Effects of Substrate Variation and Adhesive Thickness

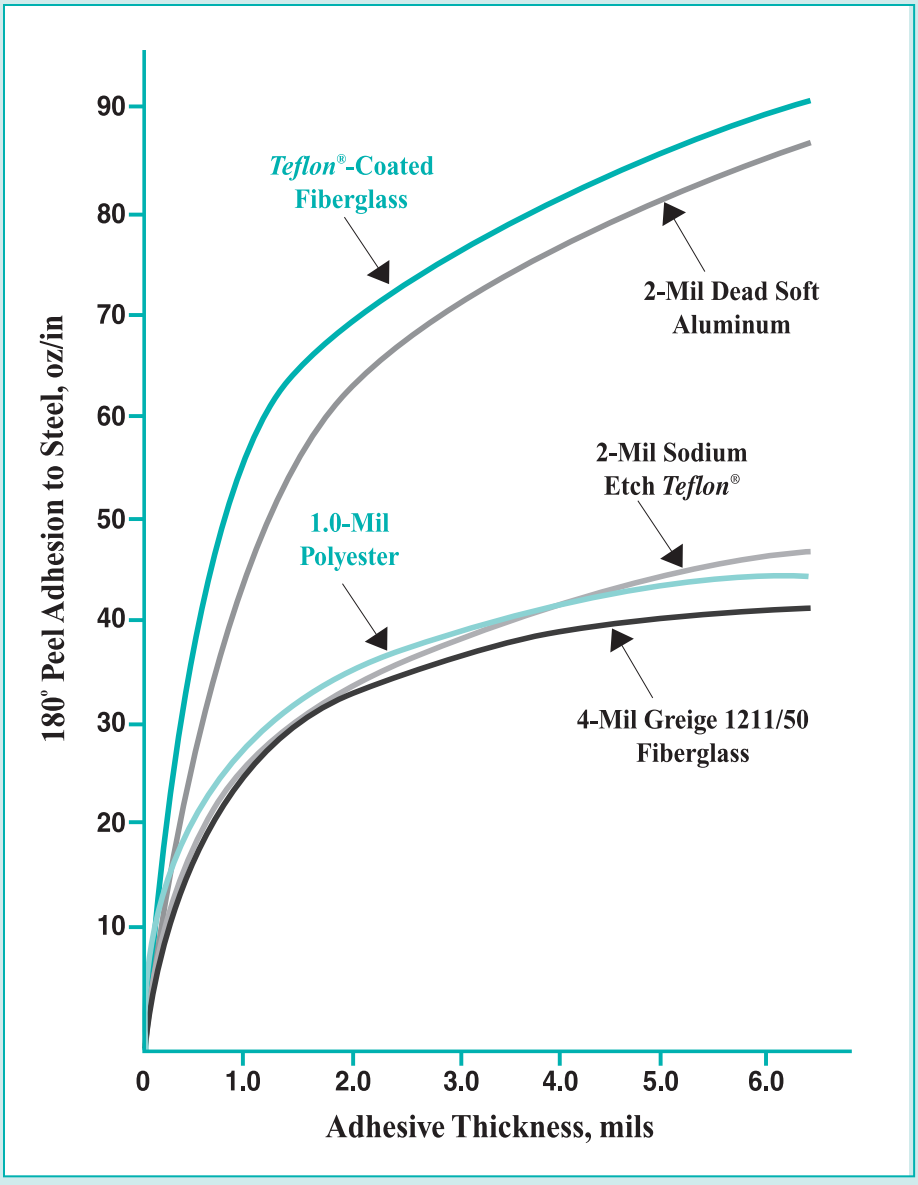
The backing material to which a silicone PSA is applied affects its tack and adhesion values. Adhesive thickness also affects adhesive performance: the thicker the cured adhesive coating, the higher the adhesion and tack. See Figures 1, 2, 4 and 5.

Platinum Cure

Dow Corning® platinum-cure adhesives require the addition of a platinum catalyst (*Syl-Off*® 4000 Catalyst) to develop PSA properties. The coating bath should be used within 24 hours of catalyst addition.

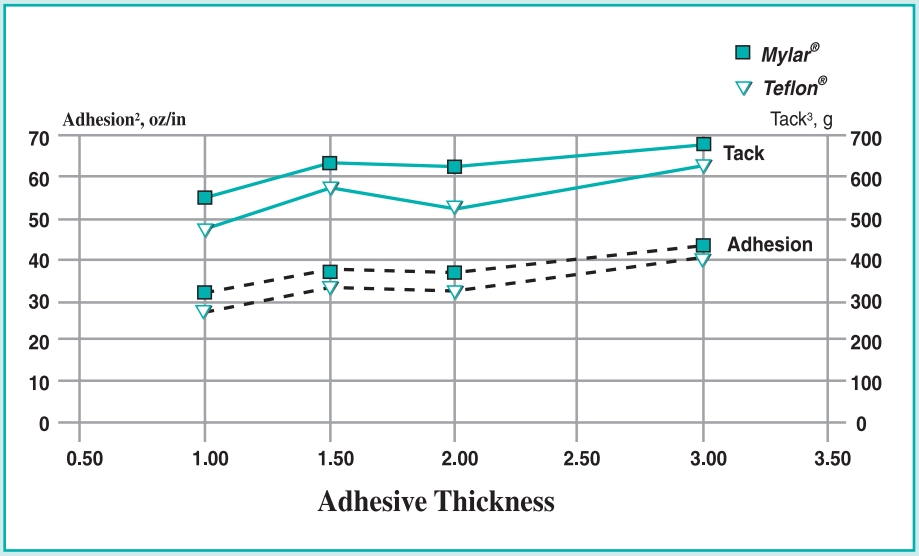
These adhesives can be cured in vented, continuous coating ovens at temperatures as low as 80°C (176°F). When coated onto flexible substrates such as polyester or polyolefin films, typical cure speeds range from 2 minutes at 100°C (212°F) to 1 minute at 125°C (257°F). If cure speed needs to be increased or process oven temperatures lowered, the catalyst level can be increased.

Figure 4. Effect of Substrate and Adhesive Thickness on Initial Adhesive Strength[1]



[1]Pressure sensitive adhesive tapes made with *Dow Corning*® 280A Adhesive and different backing materials.
Adhesive cure: 5 minutes at 150°C (300°F).
Catalyst: 1.0% powdered benzoyl peroxide based on weight of adhesive solids.
Adhesive strength determined according to ASTM D 1000.

Figure 5. Effect of Adhesive Thickness on Adhesion and Tack Properties[1]



[1]Tapes made from *Dow Corning*® 280A Adhesive; adhesive cure: 1 minute at 65°C (150°F) followed by 2 minutes at 177°C (350°F) for *Mylar*®, 2 minutes at 204°C (400°F) for *Teflon*®.
[2]Adhesive strength determined according to PSTC-1.
[3]*Polyken*® Tack: 0.5-second dwell time, 0.5 cm/second draw speed.

Changing the catalyst level has little impact on the tack, adhesion or cohesive strength of the cured adhesive.

Note: Because the catalyst is subject to contamination by peroxide and other materials, mixing and coating equipment must be thoroughly cleaned, and dedicated new containers should be used for mixing.

Peroxide Cure

To achieve a good balance of tack, adhesive strength and cohesive strength over a wide range of operating temperatures, proper cure is essential. The catalyst most typically used with silicone PSAs is benzoyl peroxide.

Peroxide concentration can be varied from 0.5 to 3.0 percent (based on adhesive solids). Increasing peroxide concentration will decrease the tack and adhesive strength of the cured coating, but will increase its cohesive strength. (See Figure 6.)

The most consistent results are achieved by using the powdered, 98 percent benzoyl peroxide. Complete blending of peroxide and adhesive is best obtained by making a 10 percent solution of the peroxide in toluene.

If a catalyst is added, the coating bath should be used within a day after mixing as the peroxide loses its activity quite rapidly in solvent. Thorough dispersion of the adhesive and peroxide during mixing is necessary to achieve uniform results in the finished product.

Curing the adhesive is a two-step process that requires the use of graded temperatures.

Solvent Removal

The first step in curing the adhesive, following its application to the backing material, is solvent removal. Recommended temperatures for solvent removal range from 65 to 93°C (150 to 200°F). Higher removal temperatures can cause the peroxide to decompose prematurely and crosslink the solvent into the adhesive. This can reduce the properties of the finished tape. The length of time for solvent removal should be sufficient to ensure that no solvent is present in the adhesive when it enters the curing zone.

Heat Cure

After the solvent is removed, a tacky, uniform film of adhesive is left on the backing. This film's adhesive and cohesive strengths, as well as the tack, can be further developed by a heat cure. The amount of cure depends on a number of factors, including the type of catalyst or equipment and backing material.

A cure of 1 minute at 66°C (150°F) for solvent removal, followed by 2 minutes at 177 to 204°C (350 to 400°F) is typically used for adhesives that contain benzoyl peroxide. If equipment and type of backing material permit the use of higher curing temperatures, the cure

time may be shortened. Higher cure temperatures develop cohesive strength of the adhesive in less time than at lower temperatures. The ultimate adhesive strength of the fully cured material is essentially the same whether cured at higher or lower temperatures. The only difference is the time required to reach complete cure.

Alternative Cure Options

Peroxide-cure silicone PSAs will develop basic PSA properties without the addition of a catalyst. Simple solvent removal followed by heat cure may be desirable for some low-temperature bonding applications. However, this procedure is not commonly used in the production of pressure sensitive adhesive tapes.

Alternatively, a tin catalyst or a silane coupling agent, such as *Dow Corning*® Z-6020 Silane, may also be used. These options will produce a PSA that bonds well and offers good adhesive strength in low-temperature applications. However, the high-temperature performance of these materials will be inferior to those cured with peroxide and will continue to cure until dry.

Oven Dusting

The evaporation of volatile silicone in the curing oven can cause the formation of oven dust. The problem is typical in solvent incineration or air-recirculating direct-fired ovens and is especially prevalent in ovens that deliver too much heat too soon in the cure process.

Two ways to reduce the problem are to

1. Select silicone PSAs with lower volatile silicone content; *Dow Corning* 7355 Adhesive or *Dow Corning* 7358 Adhesive are two examples.

2. Use ramped oven zones – oven zones with temperatures that get progressively hotter.

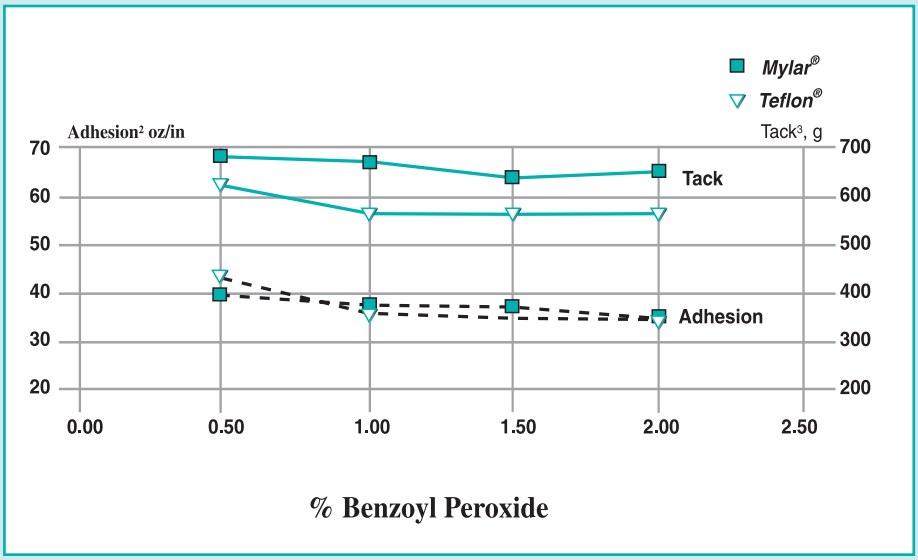
Anchorage

When silicone PSAs are used in the manufacture of self-wound tapes or laminate constructions with backings such as polyester, *Kapton*®, *Teflon*® and other plastic films, the use of a primer may be required to improve anchorage of the cured adhesive to the backing.

Good anchorage reduces the possibility of adhesive transfer during unwind, and ensures clean slitting operations and clean removability following masking. For suggested primers and sample formulations contact your Dow Corning representative.

If the application of a primer coat is not possible, anchorage to backing can be improved by adding 0.25 to 0.5 percent of a silane coupling agent, such as *Dow Corning* Z-6020 Silane, based on active adhesive weight. However, silane addition will reduce the tack of the cured adhesive and may shorten the shelf life or high-temperature properties of the tape.

Figure 6. Effect of Peroxide Level on Adhesion and Tack Properties[1]



[1]Tapes made from *Dow Corning*® 280A Adhesive; adhesive thickness: 1.5 mil; adhesive cure: 1 minute at 65°C (150°F) followed by 2 minutes at 177°C (350°F) for *Mylar*®, 2 minutes at 204°C (400°F) for *Teflon*®.
[2]Adhesive strength determined according to PSTC-1.
[3]*Polyken*® Tack: 0.5-second dwell time, 0.5 cm/second draw speed.

Release of Silicone PSAs

Dow Corning offers a fluorosilicone silicone release coating (*Syl-Off*® Q2-7785 Coating) suitable for manufacturing release liners for industrial-grade silicone PSAs.

Applications for *Syl-Off* Q2-7785 Coating include:

- Silicone PSA labels for automotive and aerospace applications, equipment labels and other die-cut applications
- Silicone PSA transfer tapes
- Wider silicone tapes using release liner or backsize
- Double-sided tapes
- Single or double-sided silicone rubber, foam or sponge insulation
- Die-cut shapes for spot protection

The release characteristics of liner made with *Syl-Off* Q2-7785 Coating depend on the specific silicone PSA used and how it is cured. *Dow Corning* Q2-7735 Adhesive and *Dow Corning* platinum-cure adhesives provide consistent, stable release when wet-cast on this liner. Refer to the *Syl-Off* Q2-7785 Coating data sheet for processing and performance details.

Other silicone PSAs from Dow Corning have also been successfully dry laminated (transfer coated) to this release system. Contact your Dow Corning representative for additional information.

For More Information and Technical Assistance

Technical assistance is readily available from your Dow Corning technical or sales representative, or by calling any of the Dow Corning global locations listed on the back of this guide. You may also contact us via e-mail through the Dow Corning Paper Manufacturing & Finishing website **www.dowcorning.com/paper**.

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Dow Corning has sales offices, manufacturing sites, as well as science and technology laboratories around the globe. Telephone numbers of locations near you are available on the world wide web at **www.dowcorning.com**, or by calling one of our primary locations listed below.

Technical Information Centers

Americas
1-800-248-2481

Asia
86 21 3774 7110

Europe
German: +49 (0)611 237 779
English: +49 (0)611 237 778
French: +49 (0)611 237 773

Your Global Connection

Asia
Dow Corning China Ltd. – Shanghai
Tel: +86 21 6288 2626

Dow Corning Asia Ltd. – Japan
Tel: +81 3 3287 1151

Dow Corning Asia – Singapore
Tel: +65 253 6611

Australia & New Zealand
Dow Corning Australia Pty. Ltd.
Tel: +61 1300 360 732

Europe
Dow Corning Europe
Tel: +00 32 64 888 000

North America
Dow Corning Corporation
World Headquarters
Tel: +1 989 496 6000

South America
Dow Corning do Brasil
Tel: +55 11 3759 4300

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