DuPont™ Neoprene
Dry Grades Selection Guide for Adhesive Applications

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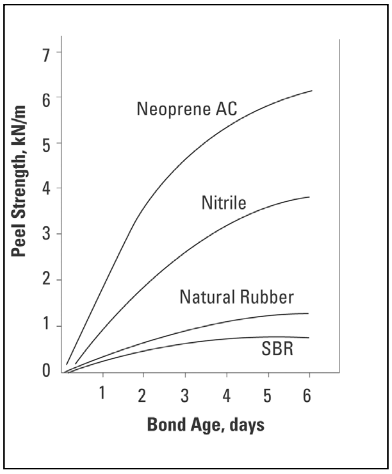
A comparison of the bond strength development for adhesives based on several rubbers is shown in Figure 1. The fast strength development of adhesives based on DuPont™ Neoprene is attributable primarily to crystallization.

Figure 1. Bond Strength Development at Room Temperature



The ability to crystallize differentiates Neoprene from other elastomer-based adhesives. The value of crystallization is the cohesive strength of the adhesive film formed from Neoprene, which is considerably greater than it would be if formed from an amorphous polymer. The "quick grab" for which adhesives based on Neoprene are noted is the result of this crystallization. Rapid development of bond strength is of immeasurable benefit to the end user who can use accelerated assembly techniques without the need for jigging, clamping, etc. Not all types of Neoprene crystallize at the same rate; DuPont™ Neoprene AD crystallizes very rapidly while other such grades as DuPont™ Neoprene WHV, crystallize more slowly. For example, Neoprene WRT is highly resistant to crystallization. This variability enables the adhesive compounder to obtain the crystallization rate desired by blending different types of Neoprene.

Crystallization is a reversible phenomenon. At temperatures above 52 °C, simple adhesives rapidly lose cohesive strength. When the film cools, it recrystallizes, regaining its former cohesive strength. The hot strength of Neoprene bonds increases slowly with time in a properly compounded glue line due to a gradual progressive crosslinking of Neoprene in the presence of zinc oxide. Where rapid development of bond strength at elevated temperatures is desired, Neoprene adhesives may be modified in a variety of ways to promote more rapid crosslinking.

Adhesive films can also be cured at room temperature by the use of ultra-accelerators, traditional in the rubber industry. The use of less active accelerators that react at higher temperatures gives greater solution stability; cure will proceed slowly in the dry adhesive film at room temperature or more rapidly at elevated temperature.

Some of the many end uses for Neoprene adhesives are listed in Table 1. Liquid dispersion adhesives are included for completeness.

Table 1
Uses for DuPont™ Neoprene Adhesives

Industrial	Furniture Industry
Decorative laminates	Fabric
Flat sheet	Foam bonding
Postformed	Chair assembly
Foil laminating	**Construction Industry**
Food packaging	Wall panel adhesive
Cartons	Floor tiles
Coated fabrics	Sandwich panels
Rubber goods mft	Al/honeycomb
Wetsuit assembly	Foam polystyrene
Seaming tarpaulins	Roofing adhesive
Seaming inflatables	Ceramic tile adhesives
Adhesive tapes	Subflooring
Film laminating	**Retail Industry**
Double glazing	Contact adhesive
Shoe Industry	Thixotropic adhesive
Sole attaching	
Lasting	
Upper assembly	
Combining	
Automobile Industry	
Vinyl landau top	
Headliners	
Trim attachment (interior and doorseal)	
Seat assembly (foam and upholstery)	

Types of DuPont™ Neoprene

There are many types of Neoprene. Those that can be dissolved in solvent can be used in adhesive formulations. The properties of the adhesives will depend on the inherent properties of the Neoprene selected. Neoprene polymers described below are types commonly used.

DuPont™ Neoprene AD

Neoprene AD is the most commonly used grade of Neoprene for adhesive applications. It crystallizes rapidly and the speed and extent of its crystallization results in quick grab and high uncured cohesive strength. Neoprene AD can be exposed to temperatures as high as 70 °C for several weeks without an appreciable change in color or hardness.

Table 2
Grades of Neoprene Regularly Used in Adhesives

			Polymer Viscosity	
		Specific Gravity	Solution Viscosity[a], MPa.s	ML after 10 passes on roll mill 1 + 4 min [100 °C]
Neoprene	AD 20	1.23	35–53	—
	W	1.23	—	40–49
	WHV 100	1.23	—	90–110
	WHV	1.23	—	106–125
	WB	1.23	—	43–52

[a] 5% by weight in toluene. Brookfield Viscosity

Note: These data are intended to describe the polymers concerned and should not be regarded as specifications.

One of the advantages of Neoprene AD is that gum cements that contain this polymer may be packaged in metal containers without discoloration. While cements without acid acceptors are not normally recommended, they are prepared by some manufacturers and for such adhesives, Neoprene AD is essential.

DuPont™ Neoprene WHV

In comparison with Neoprene AD, Neoprene WHV is a relatively slow crystallizing type. This polymer is useful in blends with Neoprene AD to increase the solution viscosity of ordinary cements. When Neoprene WHV is used as a minor component in such blends, it will not have a significant effect on bond development rate or tack.

The solubility characteristics (solubility parameter, hydrogen bonding strength, etc.) of Neoprene WHV are similar to those of Neoprene AD. Rapid solution of unmilled Neoprene WHV is possible because the product is in the form of thin chips.

Other Neoprene Types

Various other grades of DuPont™ Neoprene are regularly used in adhesives, although they were not developed primarily for this use.

DuPont™ Neoprene W is another relatively slow crystallizing type, having a comparatively low to intermediate viscosity. It may be used as a means of extending the tack range of Neoprene AD with some decrease in cohesive strength and aggressive bond development. In contrast, Neoprene WRT is essentially noncrystallizing and is used to formulate adhesives requiring improved extended tack range or a soft flexible glue line.

DuPont™ Neoprene GNA and GRT are less stable during storage than the Neoprene W types. They are more reactive with isocyanates and curatives and can be used in formulations which are intended either for two-part adhesives or as curable compositions.

DuPont™ Neoprene WB is used to provide high gel content without adversely affecting the rheology of the adhesive. It will provide good hot bond strength and is particularly suitable for use in applications where hot creep resistance is desirable. However, it has essentially no tack, and it is essential, therefore, to blend Neoprene WB with other Neoprene types in contact adhesives.

Information on European Union Dangerous Preparations Directive 1999/45/EC related to Colophony Skin Sensitization

Colophony is classified as a skin contact sensitizer under European Union Dangerous Preparations Directive 1999/45/EC effective July 30, 2002. This Directive requires labeling of products that contain colophony at levels equal to or greater than 0.1% (refer to the Directives for specific details). Solid (dry type) Neoprene adhesive grade products manufactured by DuPont contain about 4% colophony (CAS No. 8050-09-7). Toxicological tests have demonstrated that dry Neoprene is not a skin sensitizer. Because of this testing, dry Neoprene polymer is not subject to mandatory labeling under the above Directive despite the presence of the colophony. However, when these Neoprene adhesive grade products are dissolved in organic solvents, the colophony may still be present at concentrations up to 0.8% depending on the solids content of the solutions. In the absence of data showing the adhesive is not a skin sensitizer, the adhesive could be subject to the above EU regulation.

We recommend that manufacturers and marketers of adhesive solutions containing DuPont™ Neoprene (dry type) adhesive grade products determine whether the colophony level is above 0.1%. If the manufactured preparation has a colophony content of less than 0.1%, it will not be subject to mandatory labeling (provided no other constituents necessitate mandatory labeling). Manufactured preparations that contain higher colophony contents will require the labeling and/or container notices described in the Directive.

Comparison Chart of DuPont™ Neoprene

Family Characteristics	Type	Co-Monomer	Raw Polymer Stability	Viscosity	Crystallization Rate	Distinguishing Features
A Polymers	AD20	None	Excellent	Solution 35–53	Rapid	Fast crystallizing
W Polymers	W M1	None	Excellent	Mooney 34–42	Fast	General purpose-low viscosity
	W	None	Excellent	Mooney 40–49	Fast	General purpose-standard viscosity
	WHV 100	None	Excellent	Mooney 90–110	Fast	General purpose-medium high viscosity
	WHV	None	Excellent	Mooney 106–125	Fast	General purpose-high viscosity
	WRT	2,3-dichloro-1,3-butadiene	Excellent	Mooney 41–51	Very Slow	Very slow crystallizing; Slower curing than W
	WD	2,3-dichlor-1,3-butadiene	Excellent	Mooney 100–120	Very Slow	High Viscosity WRT

Mooney = ML (1+4) at 100 °C
Solution = Brookfield Model LVT at 6 or 3 rpm, 5% polymer by weight at 25 °C in 100% toluene
*Adhesive viscosity 10% solids in toluene

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Caution: Do not use in medical applications involving permanent implantation in the human body. For other medical applications, discuss with your DuPont customer service representative and read Medical Caution Statement H-50103-3.

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