

Poly bd[®] Resin-Based Polyurethane Derives Significant Benefit from Carbon Black Reinforcement



Benefits

- Ease of dispersion
- Improved mechanical properties
- Potential for improved antistatic, weatherability, and abrasion resistance properties

Target Markets

- Adhesives
- Sealants
- Polymer/rubber modification
- Hose and tube
- Wire and cable
- Footwear
- Film and sheet

Additional Information

MSDS/TDS: Poly bd[®] R45HTLO

Description

Poly bd[®] resin-based polyurethanes have a polymer backbone structure similar to conventional diene rubber vulcanizates. Just as these conventional systems respond to carbon black reinforcement, Poly bd resin-based polyurethanes can also be reinforced with carbon blacks, as well as a variety of other fillers. Although carbon blacks must be master-batched into conventional elastomers using high-shear mixers, they are readily dispersed into liquid Poly bd resins. Thus, reduced cost processing is available to rubber goods manufacturers.

Study Results

Previously, Cray Valley studied the effect of carbon black and other fillers on Poly bd resin-based polyurethane properties (see link below). Monarch[®] 580, a new carbon black from Cabot Corporation, was recently evaluated against their Elftex[®] 5, which was used in the original study. Polyurethane dispersions containing up to 7.5 weight percent of each carbon black were prepared using typical laboratory stirring equipment. Table 1 shows these compositions, and mechanical properties versus a comparable system without carbon black.

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Hydrocarbon Specialty Chemicals

Table 1. Effect of Carbon Black on Polyurethanes Derived from Poly bd Resins

Lot No. 651-133-	1	8	2	4	6	5	7
Poly bd R45HTLO Resin	100	100	100	100	100	100	100
Isonate™ 143L (Dow Chemical Co.)	12.55	12.55	12.55	12.55	12.55	12.55	12.55
Elftex® 5 Carbon Black (Cabot Corp.)	---	2.89	5.92	9.13	---	---	---
Monarch® 580 Carbon Black (Cabot Corp.)	---	---	---	---	2.89	5.92	9.13
20% T-12 in Dibutyl Phthalate, Drops	3	0	3	0	2	2	0
Wt.% Carbon Black	0	2.5	5	7.5	2.5	5	7.5
Physical Properties							
Hardness, Shore A	52	54	55	57	54	56	60
Tensile Strength, psi	168	236	298	325	237	283	398
Modulus, psi	117	133	150	153	131	142	158
Elongation, %	95	133	150	154	139	153	187
Tear Resistance, Lbf/in	23	35	41	37	37	40	60

As shown above, the addition of carbon black improves all mechanical properties. The new Monarch 580 carbon black produces mechanical property results generally superior to those for the Elftex 5 grade.

For reference, Table 2 lists the test protocols used in the above study.

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Table 2. Test Methods Used to Evaluate Poly bd Elastomers

Physical Property Tested	Method
Tensile Strength, psi	ASTM D-412-61T
Tensile Modulus, psi	ASTM D-412-61T
Elongation, %	ASTM D-412-61T
Tear Resistance, Lbf/in	ASTM D-642-51 (die C)
Hardness, Shore A	ASTM D-676-59T

Conclusions

- The use of carbon black in Poly bd-based elastomers can result in significant improvements in mechanical properties.
- Non-black fillers, e.g., calcium carbonate and zinc oxide, may also alter physical properties and reduce costs.
- Non-black fillers may offer several advantages, including:
 - Easy dispersion
 - Low viscosity buildup
 - Light color
 - High loadings

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