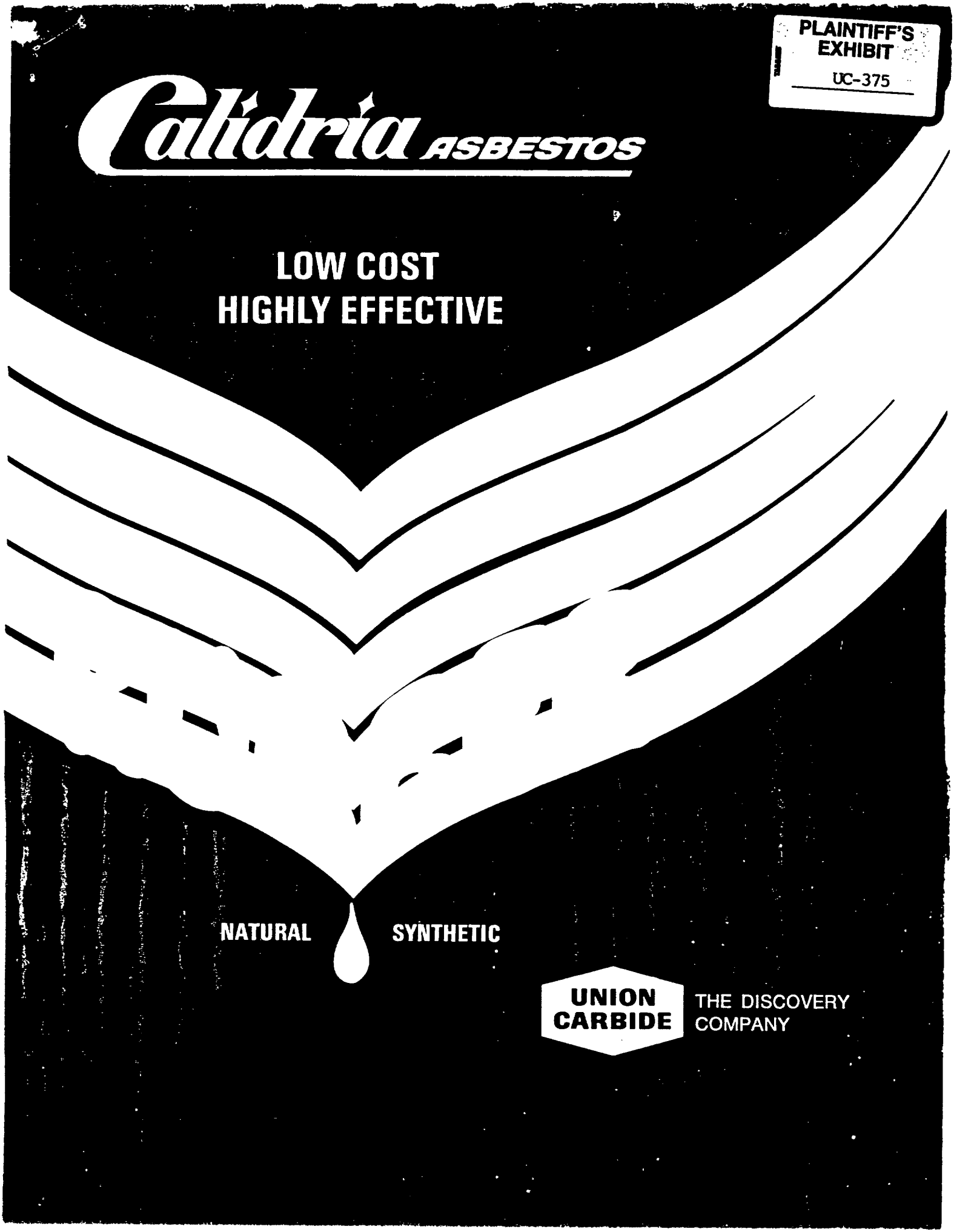


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Two Grades of **Calidria** Asbestos for Rubber

HIGH-PURITY ASBESTOS
— an exceptionally pure, light-colored, non-abrasive asbestos fiber for all rubber systems.

T-135
— a high-purity asbestos uniquely bonded with titania for use in white or light-colored systems.

Property Benefits:

LOW-COST FILLER AND REINFORCER — "Calidria" asbestos is unique among low-cost rubber fillers. It is a reinforcing filler, providing dimensional stability and improved strength with minimum effect on other physical properties. It does this by optimizing the polymer/filler interaction through its small particle size, high length/diameter ratio, and relatively large surface area. This high-purity fiber is also low in magnetite and other contaminants that adversely affect physical properties. Rubber manufacturers can add high loadings of "Calidria" asbestos to both natural and synthetic rubber to take advantage of these property benefits.

GOOD ABRASION RESISTANCE — "Calidria" asbestos markedly improves the abrasion resistance of rubber. In tests on the DeMattia abrasion tester, this high-purity fiber gives equal or better abrasion resistance than other asbestos products.

TYPICAL PHYSICAL PROPERTIES

	High-Purity	T-135	
Specific Gravity	2.45	2.45	—
Moisture Content	2.0-3.0	2.0-3.0	% by weight
Nature of Surface Charge	Cationic	Cationic	—
Magnetite Content	0.7	0.5	% by weight
Oil (DOP) Absorption	120	100	lb. per 100 lb.
Surface Area	60	60	sq. m. per g.
Length/Diameter (Aspect Ratio)	200/1	200/1	—
Brightness (G.E. Photovoltmeter)	75	86	%
pH in Water (2% slurry)	9	9	—

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Processing Benefits:

FAST DISPERSION, MINIMUM RUGOSITY — The small, uniform fibers of "Calidria" asbestos disperse easily in rubber compounds with conventional mixing equipment. They also permit smooth calendering and extrusions with a minimum of surface rugosity.

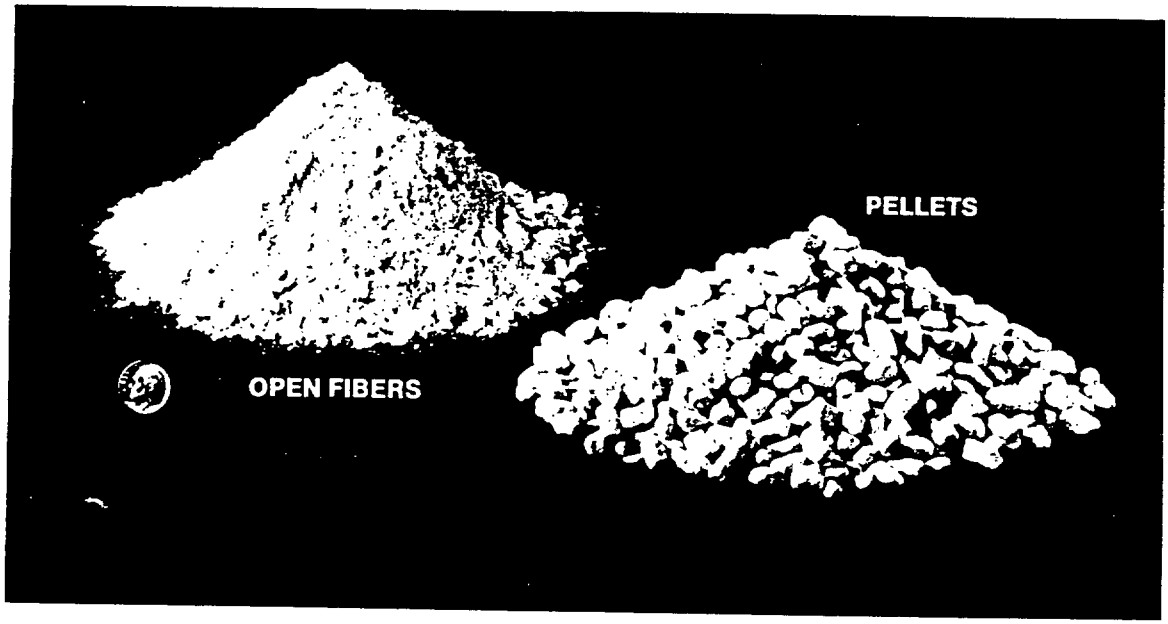
EXTENDED DIE LIFE—Because of its high purity, "Calidria" asbestos has a minimum of magnetite and rock particles that can wear dies. Thus, nylon dies can be used to extrude rubber compounds containing "Calidria" asbestos with minimum wear.

CONTROLLABLE CURES—The low magnetite and uniform pH of 9 in "Calidria" asbestos gives more controllable cure rates in rubber compounds containing this unusual fiber.

SEPARATE TiO_2 ADDITIONS ELIMINATED—Rubber manufacturers adding TiO_2 as a pigment for non-black systems can save an additional step by using "Calidria" asbestos T-135. This titanated asbestos product provides sufficient TiO_2 for pigmentation at the same time it provides high-purity asbestos as a reinforcing filler. The TiO_2 is uniformly distributed on the asbestos fibers, aiding dispersion when added to the rubber system.

Handling Benefits:

PELLETS REDUCE DUST—"Calidria" asbestos is available as either dust free pellets or open fibers, packed in bags. The pellets are so rugged that they can be handled in bulk with minimum dust. This popular feature, available exclusively with "Calidria" asbestos, allows cleaner operations during materials handling and addition to rubber. It also allows easier handling and storage, lower freight costs, and better automatic feed, as described on the next page.



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PACKAGING AND AVAILABILITY

	High-Purity and T-135 PELLETS	High-Purity and T-135 OPEN FIBER
Single Package — Weight (3-ply paper bag)	50 lb.	40 lb.
Single Pallet — Weight Dimensions	2,000 lb. approx. 46 in. x 39 in. x 48 in. high	1,600 lb. approx. 55 in. x 45 in. x 60 in. high
Full Carload (available from King City plant)	60 pallets 120,000 lb.	52 pallets 83,200 lb.
Full 40-ft. Truckload (available from several locations nationwide)	20 pallets 40,000 lb.	17 pallets 27,200 lb.

EASIER HANDLING AND STORAGE — "Calidria" asbestos pellets are over twice as dense as the open fibers. One ton of pellets occupies only 46 cu. ft. of space compared to over 100 cu. ft. for one ton of typical open fiber products. By using pellets, rubber manufacturers can speed handling and cut storage space in half.

LOWER FREIGHT COSTS TOO—A box car can be loaded to its full 120,000 lb. capacity when pellets are specified. In comparison, only 83,200 lb. of open fiber can be loaded in the same car. Thus, pellets can save up to 20% on rail shipping costs by permitting use of lower tariffs. The high density of "Calidria" asbestos pellets also offers savings in truck freight costs in many parts of the country, while substantial savings in ocean shipping costs can be made by shipping pellets overseas.

FEED AUTOMATICALLY—"Calidria" asbestos pellets are ideally suited for operations using automatic feed equipment. They flow quickly and smoothly through the equipment, with a minimum of dust to clog the system. Producers using Banbury mixers will find the high bulk density of the pellets permits optimum loadings.

Why is "Calidria" asbestos different?

"Calidria" asbestos is a high-purity, short-fiber chrysotile asbestos obtained from a unique deposit about 160 miles south of San Francisco, California. Unlike conventional deposits that extend through the host rock, this deposit is essentially free of hard, consolidated rock masses. Further, the ore assays up to 60% asbestos fiber compared to other deposits which contain from 6 to 10% asbestos.

Special hydraulic beneficiation techniques developed by Union Carbide efficiently break down the fiber bundles and remove the rock and impurities from the asbestos fiber. As a result, "Calidria" products are over 95% pure asbestos whose fibers have been over 98% liberated from fiber bundles. These high-purity fibers are then sold as open fibers or are pelletized for convenient, dust-free handling and storage.

"Calidria" asbestos T-135 is a high-purity asbestos fiber to which are bonded uniformly dispersed particles of TiO_2. The strong attraction between the positively charged asbestos and the negatively charged TiO_2 prevents agglomeration of the TiO_2, aiding dispersion in rubber systems.

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1. CANADIAN ASBESTOS AS-MINED
These fiber bundles are straight and tightly bonded, surrounded by masses of rock. In this form, the fibers defy separation from each other and from the host rock.



2. "CALIDRIA" ASBESTOS AS-MINED
Here the fibers are randomly oriented and essentially free of hard rock masses. Further, the ore assays up to 60% asbestos, considerably more than the Canadian ore.



3. "CALIDRIA" ASBESTOS IF DRY-PROCESSED
The most exacting dry processes do not completely break down the fiber bundles into individual fibers. Union Carbide developed a special wet process to do this.



4. WET-PROCESSED "CALIDRIA" ASBESTOS
Union Carbide's process separates 98% of the fibers from the fiber bundles. These fibers can be bought open or in convenient, dust-free pellets whose fibers disperse quickly when added to rubber.



5. T-135 WITH UNIFORMLY DISPERSED TiO_2
The TiO_2 particles are kept dispersed by a strong attraction between the positively charged asbestos and the negatively charged TiO_2. This gives good dispersion of the TiO_2 in rubber.

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Typical Performance Data

NATURAL RUBBER (NR)

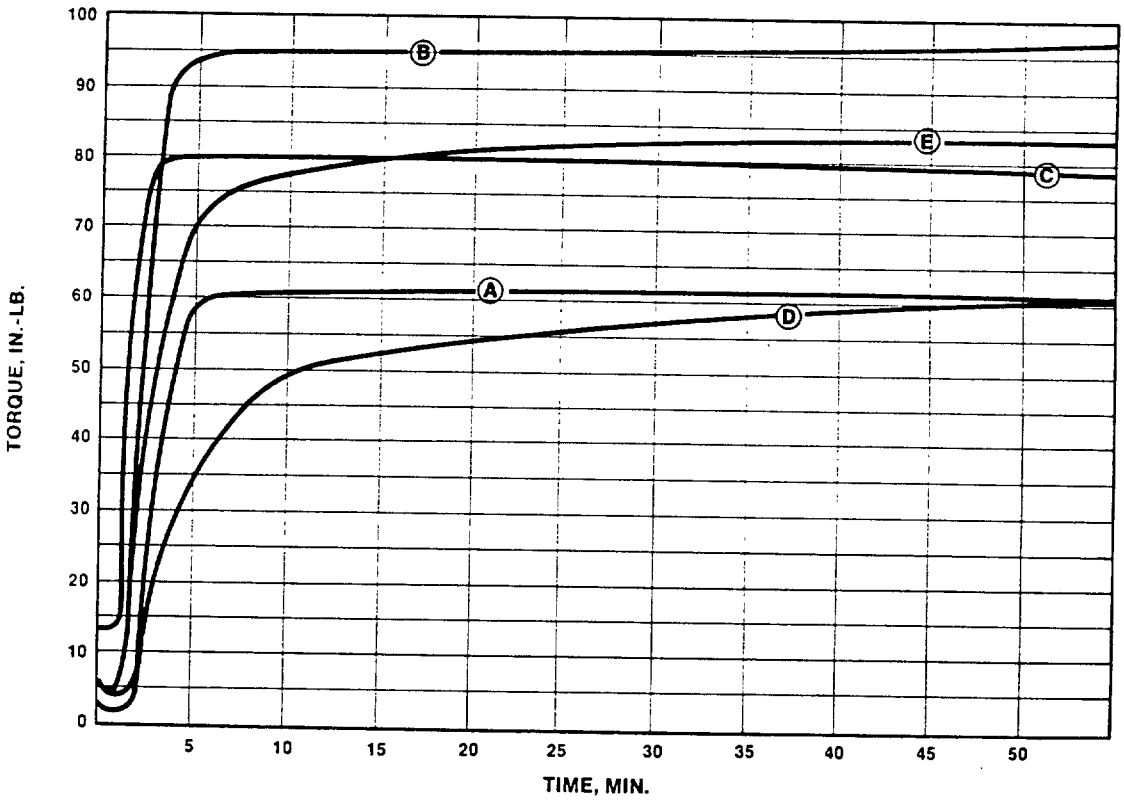
In extensive tests in natural rubber, "Calidria" asbestos has been found to be an effective filler and reinforcer. As shown in Columns A and B at the right, 20 and 65 parts of "Calidria" high-purity asbestos per hundred rubber were added to a black, sulfur-cured system. The asbestos addition gave moderate increases in tensile, hardness, and tear die C properties while substantially increasing the modulus at 100%, 200%, and 300% elongation.

Similarly, high tensile, hardness, modulus, and tear die C properties were obtained in a non-black system containing 50 pphr of "Calidria" asbestos and 15 pphr of precipitated silica. These data are shown in Column C.

To test the effectiveness of "Calidria" asbestos in alternate curing systems, 65 pphr of the fiber were added to natural rubber having a faster sulfur cure (Column D). As a comparison, 65 pphr of "Calidria" asbestos was also added to natural rubber having the sulfur cure previously used (Column E). "Calidria" asbestos was the only filler added to each system. The data in Columns D and E show that "Calidria" asbestos contributed to the high properties obtained in both systems.

In all systems, optimum processing safety was obtained as noted by the Mooney scorch values. In addition, "Calidria" asbestos gave fast, controllable cures, as shown by the curves below.

CURE CHARACTERISTICS • Monsanto Oscillating Disc Rheometer



Temperature—320°F.; Amplitude—3°; OPM—3; Preheat—60 sec.

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INGREDIENTS AND PHYSICAL PROPERTIES

NATURAL RUBBER (NR)	BLACK SYSTEM		NON-BLACK SYSTEM	TWO SULFUR CURING SYSTEMS	
	A	B	C	D	E
INGREDIENTS, pphr					
SMR-H5L	100	100	100	100	100
MT Carbon Black (1)	20	20	—	—	—
Precipitated Silica (2)	—	—	15	—	—
"Calidria" High-Purity Asbestos Pellets	20	65	50	65	65
Stearic Acid	1	1	1	4	1
Zinc Oxide	5	5	5	5	5
Sulfur	1.5	1.5	1.5	2.5	1.5
Mercaptobenzothiazole	0.5	0.5	0.5	—	0.5
Tetramethylthiuram Disulfide	1.5	1.5	1.5	—	1.5
Benzothiazyl Disulfide	—	—	—	0.7	—
Diphenylguanidine	—	—	—	0.3	—
MOONEY SCORCH, T_5MS1 @ 250°F., min. (ASTM D1646-68)	4	3	4	6	4
MOLD CURE	20 min./ 320°F.	20 min./ 320°F.	20 min./ 300°F.	20 min./ 320°F.	20 min./ 320°F.
PROPERTIES					
Hardness, Shore A (ASTM D2240-68)	60	80	80	77	78
Tensile, psi (ASTM D412-68)	1,900	2,100	2,200	2,025	2,000
Elongation, % (ASTM D412-68)	450	350	250	350	350
Modulus, psi (100%) (ASTM D412-68)	425	900	1,350	800	900
(200%) (ASTM D412-68)	650	1,200	1,775	1,100	1,100
(300%) (ASTM D412-68)	1,025	1,800	—	1,700	1,500
Tear Die C, ppi (ASTM D624-54)	250	300	425	350	350
Compression Set, (22 Hr./158°F.), % (Method B) (ASTM D395-67)	40	50	55	60	60

(1) Cabot Corp.'s "Sterling" MT
(2) PPG's "Hi-Sil" 233

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Typical Performance Data

ETHYLENE PROPYLENE DIENE MONOMER (EPDM)

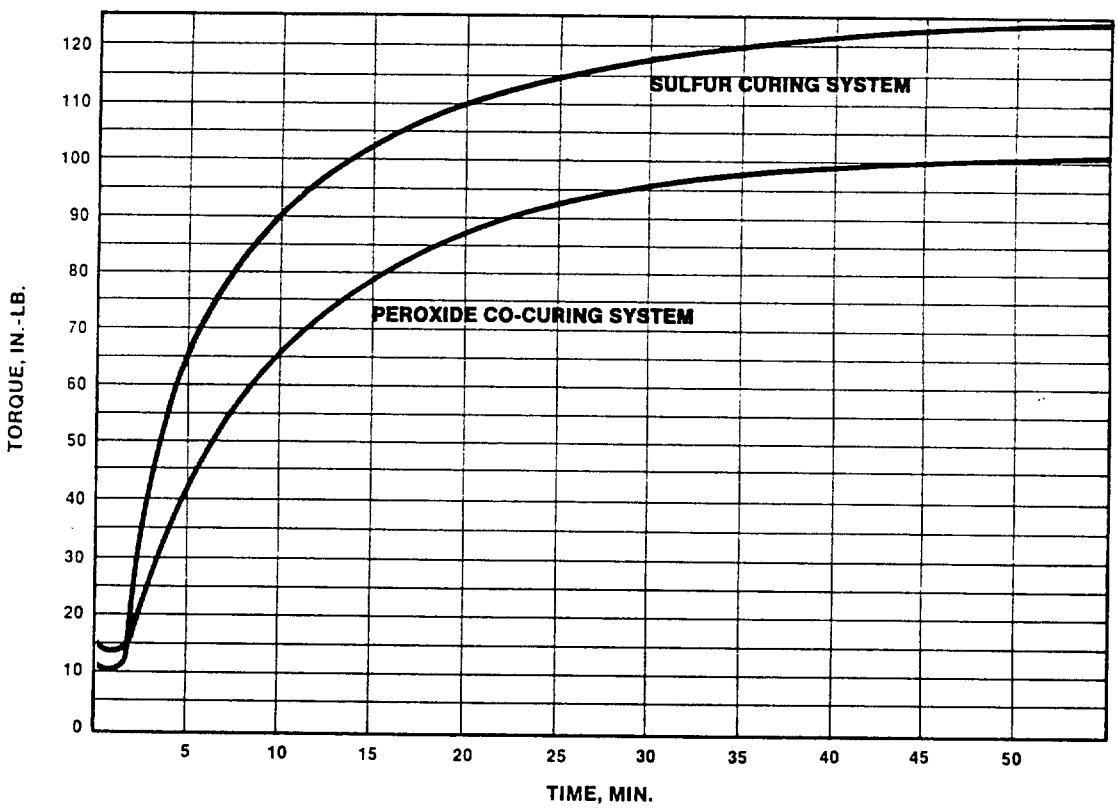
"Calidria" asbestos also increased the properties of EPDM, particularly the modulus and tear die C values. As shown in Columns A and B at the right, 50 and 65 parts of "Calidria" high-purity asbestos per hundred rubber were added to a black, sulfur-cured system. The system containing 65 parts of "Calidria" asbestos had substantially higher modulus and tear die C properties than the system containing 50 parts of the fiber. In addition, hardness and tensile strength increased slightly with the larger filler addition.

Columns C and D compare the addition of 50 and 65 pphr of "Calidria" asbestos in black EPDM using a peroxide co-curing system. Although properties are not as high as with the sulfur-curing system, the effect of "Calidria" asbestos in improving tensile, hardness, modulus, and tear properties is clearly shown.

In Columns E and F, 50 pphr of "Calidria" asbestos were added to non-black EPDM using sulfur and peroxide co-curing systems respectively. The reinforcing effect of this high-purity fiber, working together with precipitated silica, is shown to yield high properties.

In all tests, processing safety was assured by the uniform Mooney scorch values. Controllable cure rates were obtained as the curves for each cure system closely followed the lines shown below.

CURE CHARACTERISTICS • Monsanto Oscillating Disc Rheometer



Temperature—320°F.; Amplitude—3°; OPM—3; Preheat—60 sec.

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INGREDIENTS AND PHYSICAL PROPERTIES

ETHYLENE PROPYLENE DIENE MONOMER (EPDM)	BLACK, SULFUR-CURED SYSTEM		BLACK, PEROXIDE CO-CURED SYSTEM		NON-BLACK SYSTEM	
					SULPHUR-CURED	PEROXIDE CO-CURED
	A	B	C	D	E	F
INGREDIENTS, pphr						
EPDM	100	100	100	100	100	100
SRF Carbon Black (1)	20	20	20	20	—	—
Precipitated Silica (2)	—	—	—	—	15	15
"Calidria" High-Purity Asbestos	50	65	50	65	50	50
Stearic Acid	1	1	—	—	1	—
Zinc Oxide	5	5	—	—	5	—
Sulfur	1.5	1.5	—	—	1.5	—
Mercaptobenzothiazole	0.5	0.5	—	—	0.5	—
Tetramethylthiuram Disulfide	1.5	1.5	—	—	1.5	—
Dicumyl Peroxide (40% on $CaCO_3$)	—	—	5	5	—	5
Trimethylol Propane Trimethacrylate	—	—	4	4	—	4
MOONEY SCORCH, T_5MS1 @ 250°F., Min. (ASTM D1646-68)	9	9	9	9	9	9
MOLD CURE	30 min./ 320°F.	30 min./ 320°F.	30 min./ 320°F.	30 min./ 320°F.	30 min./ 320°F.	30 min./ 320°F.
PROPERTIES						
Hardness, Shore A (ASTM D2240-68)	81	85	80	83	85	81
Tensile, psi (ASTM D412-68)	1,950	2,100	1,900	2,000	2,150	2,000
Elongation, % (ASTM D412-68)	325	325	350	350	400	375
Modulus, psi (100%) (ASTM D412-68)	1,000	1,250	700	850	1,100	900
(200%) (ASTM D412-68)	1,400	1,500	950	1,000	1,200	1,075
(300%) (ASTM D412-68)	1,650	1,900	1,400	1,500	1,400	1,250
Tear Die C, ppi (ASTM D624-54)	275	375	250	300	375	275
Compression Set, (22 Hrs./158°F.), % (Method B) (ASTM D395-67)	40	45	40	45	45	40

(1) Cabot Corp's "Sterling" S
(2) PPG's "Hi-Sil" 233

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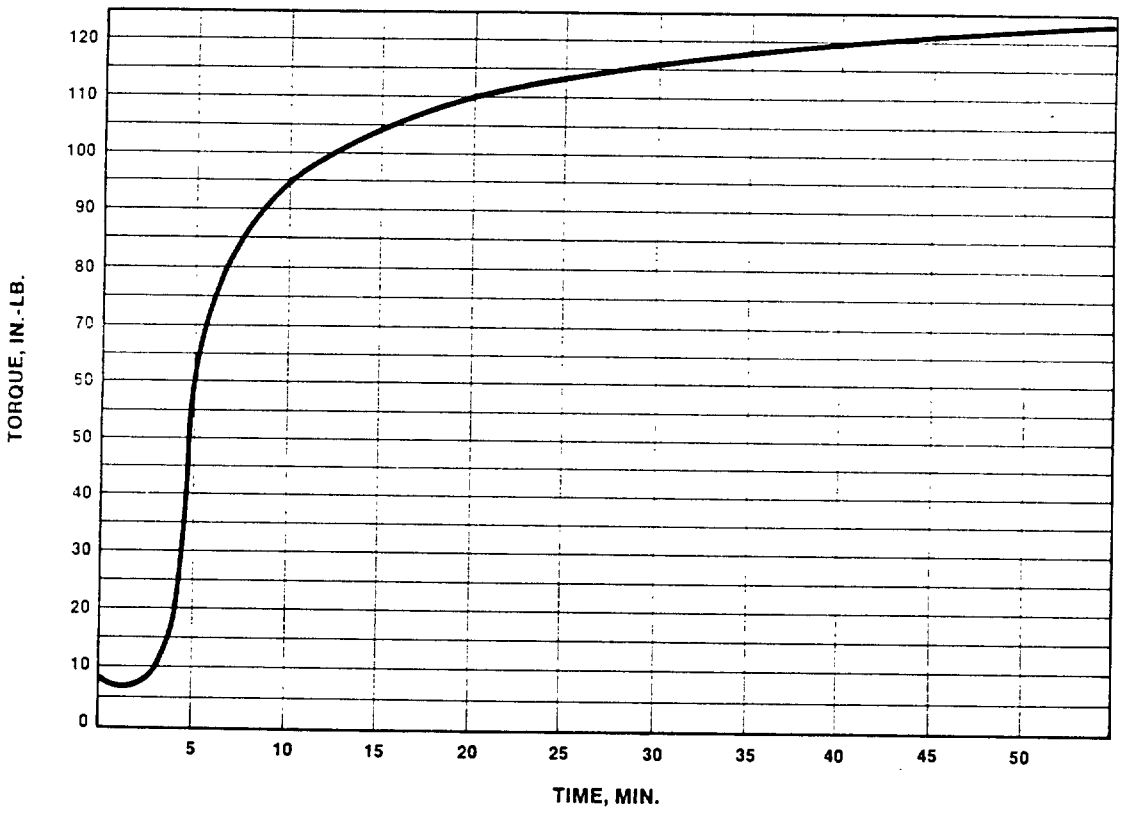
Experimental Data

STYRENE BUTADIENE RUBBER (SBR)

In this experimental SBR shoe-sole formulation, "Calidria" asbestos T-135 was used as a filler, reinforcer, and pigment. As shown at the right, the combined reinforcing characteristics of the T-135 and precipitated silica gave optimum tensile strength and excellent 300% modulus and tear die C properties. At the same time, the T-135 introduced sufficient TiO_2 for color flattening, eliminating the need for separate TiO_2 additions. The TiO_2 added with the asbestos fibers dispersed quickly and uniformly in the formulation.

This experimental formulation was cured with an augmented sulfur system having a short cure cycle at 320°F. By augmenting the sulfur with hexa/resorcinal, a cure rate with optimum scorch values was obtained that is adaptable to injection molding.

CURE CHARACTERISTICS • Monsanto Oscillating Disc Rheometer



Temperature—320°F.; Amplitude—3°; OPM—3; Preheat—60 sec.

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INGREDIENTS AND PHYSICAL PROPERTIES

STYRENE BUTADIENE RUBBER (SBR)		
INGREDIENTS, pphr		
SBR-1502		100
Precipitated Silica (1)		40
"Calidria" Asbestos T-135		25
Napthenic Oil		5
Stearic Acid		2
Zinc Oxide		5
Sulfur		2.5
Diorthotolylguanidine		1.2
Benzothiazyl Disulfide		0.8
Resorcinol		4.2
Hexamethylenetetramine		3.2
MOONEY SCORCH,		
T_5MS1 @ 250°F., Min.	(ASTM D1646-68)	9
MOLD CURE		10 min./ 320°F.
PROPERTIES		
Hardness, Shore A	(ASTM D2240-68)	80
Tensile, psi	(ASTM D412-68)	2,700
Elongation, %	(ASTM D412-68)	425
Modulus, psi (100%)	(ASTM D412-68)	800
(200%)	(ASTM D412-68)	1,425
(300%)	(ASTM D412-68)	1,975
Tear Die C, ppi	(ASTM D624-54)	400

(1) PPG's "Hi-Sil" 233

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Any of our offices below will be glad to give you complete information on properties, applications, and prices of "Calidria" asbestos.

Calidria ASBESTOS

Sales Offices

Atlanta, Georgia 30329	17 Executive Park Dr.	404-633-6161
Baltimore, Maryland 21207	Beltway Bldg. 6707 Whitestone Rd.	301-944-8211
Boston, Massachusetts 02194	300 First Ave., Needham Heights	617-444-5400
Buffalo, New York 14225	3343 Harlem Rd.	716-837-6450
Charlotte, North Carolina 28210	6230 Fairview Rd.	704-364-1400
Chicago, Illinois 60606	120 South Riverside Plaza	312-822-7000
Cincinnati, Ohio 45227	West Street and Madisonville Rd.	513-272-0206
Cleveland, Ohio 44114	1300 Lakeside Ave., N.E.	216-621-4202
Clifton, New Jersey 07012	935 Allwood Rd.	201-778-2900
Dallas, Texas 75207	2710 Stemmons Freeway	214-631-0010
Detroit (Southfield, Michigan Sales Office)		313-354-0800
Houston, Texas 77027	3737 Greenway Plaza Dr.	713-621-1000
Indianapolis (Cincinnati, Ohio Sales Office)		317-255-3181
Kansas City (St. Louis, Mo. Sales Office)		913-362-2200
Los Angeles, California 90058	2770 Leonis Blvd.	213-583-3061
Memphis (Atlanta, Ga. Sales Office)		901-396-5375
Minneapolis, Minnesota 55416	3030 Excelsior Blvd.	612-927-4221
Moorestown, New Jersey 08057	Route 38 and Pleasant Valley Rd.	609-235-6200
New York, New York 10017	270 Park Ave.	212-551-6423
Philadelphia (Moorestown, New Jersey Sales Office)		215-923-3200
Pittsburgh, Pennsylvania 15220	P'kway Center, 875 Greentree Rd.	412-922-5700
Southfield, Michigan 48075	26500 Northwestern Highway	313-354-0800
St. Louis, Missouri 63105	10 South Brentwood Blvd.	314-726-0324
San Francisco, California 94106	One California St.	415-982-1360
Seattle, Washington 96118	4726 Rainier Ave., South	206-723-8660

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