TECHNICAL Bulletin

Subject: EPDM Tire Flaps

Bulletin #: 013

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THERMAX® MEDIUM THERMAL BLACK N990 IN EPDM TIRE FLAPS

Thermax® medium thermal carbon black N990 is manufactured by the thermal decomposition of natural gas. The thermal process provides a unique carbon black characterized by a large particle size and low structure. Thermax® is widely used in applications which require excellent dynamic properties. The large particle size (low surface area) and low structure allow for low compression set, high rebound and low hysteresis, thereby maintaining the inherent elastomeric properties of the rubber compound. As a non-reinforcing black, thermal black is often blended with furnace carbon blacks and/or mineral fillers to achieve cost reduction and specific physical properties in the rubber compound.

This technical bulletin provides the results of Cancarb's tests of Thermax® in various loadings in EPDM tire flaps. Performance benefits from Thermax® in this application include:

- High loadability in tire flaps, compared to using only furnace grades
- Reduction of compound cost due to high black loading
- Maintenance of low hardness, preventing edge tear in tubes
- Excellent rebound, low compression set, low heat build-up

The following data demonstrates the application of Thermax® N990 as a filler in EPDM tire flaps compounds. The filler loading is maximized to reduce compound cost.

Bayer Formulations

	Flap 1	Flap 2	Flap 3	Flap 4
Bayer 5459	160.0	160.0	160.0	160.0
Bayer 345	20.0	20.0	20.0	20.0
N660	180.0	180.0	150.0	125.0
Thermax® N990	150.0	200.0	150.0	150.0
Sunpar 2280	90.0	90.0	75.0	75.0
Zinc Oxide	5.0	5.0	5.0	5.0
Stearic Acid	1.0	1.0	1.0	1.0
Thiuram M	0.75	0.75	0.75	0.6
Butyl Zimate	0.75	0.75	0.75	2.0
MBT	0.75	0.75	0.75	-
Sulfasan R	-	-	-	1.0
Thiuram E	0.75	0.75	0.75	0.6
Sulphur	1.0	1.0	1.0	0.5
TOTAL	**610.0**	**660.0**	**565.0**	**540.7**

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Compound Properties

Oscillating Disk Rheometer, ASTM D 2084 - 95, 160°C				
Min, dN•m	10.8	10.5	8.1	6.0
Max, dN•m	29.7	29.1	28.5	23.7
ts2, dN•m	13.3	13.1	10.4	8.4
tc 90%, minutes	13.88	14.63	14.30	14.31
tc 95%, minutes	17.41	18.51	18.06	17.45
Cure Rate Index	9.22	8.52	8.84	9.95
Stress-Strain, ASTM D 412 - 92, RT, Cure Conditions T95 x 160°C				
Hardness, Shore A	66	68	65	56
Elongation (%)	257	231	403	644
Tensile (MPa)	7.8	7.6	8.1	7.4
100% Modulus, MPa	3.5	3.7	2.8	1.7
200% Modulus, MPa	6.7	6.8	5.7	3.7
400% Modulus, MPa	-	-	8.2	5.6
Stress-Strain, Aged 24 hours @ 121°C, ASTM D 412 - 95, Cure Conditions T95 x 160°C				
Hardness, Shore A	71	72	70	60
Elongation (%)	200	165	276	450
Tensile (MPa)	8.7	8.1	9.0	8.1
100% Modulus, MPa	4.8	5.3	4.1	2.4
200% Modulus, MPa	8.7	-	7.5	5.1
400% Modulus, MPa	-	-	-	7.7

Nordel Formulations

	Flap 5	Flap 6
Nordel 1660	100.0	100.0
SRF N774	200.0	-
GPF N660	-	180.0
Thermax® N990	100.0	150.0
Sunpar 2280	150.0	150.0
Zinc Oxide	5.0	5.0
Stearic Acid	1.0	1.0
Thiuram M	0.6	0.6
Butyl Zimate	2.0	2.0
Sulfasan R	1.0	1.0
Sulphur	0.5	0.5
Thiuram E	0.6	0.6
Total	**560.7**	**590.7**

Compound Properties

Oscillating Disk Rheometer, ASTM D 2084 - 95, 160°C		
Min, dN•m	4.4	5.2
Max, dN•m	16.4	20.1
ts2, dN•m	6.9	7.6
tc 90%, minutes	12.72	16.76
tc 95%, minutes	14.89	19.54
Cure Rate Index	13.26	8.64
Stress-Strain, ASTM D 412 - 92, RT, Cure Conditions T95 x 160°C		
Hardness, Shore A	57	61
Elongation (%)	575	474
Tensile (MPa)	4.65	6.0
100% Modulus, MPa	1.1	1.5
200% Modulus, MPa	2.2	3.5
300% Modulus, MPa	3.36	4.9
400% Modulus, MPa	4.03	5.7
Stress-Strain, Aged 24 hours @ 121°C, ASTM D 412 - 95, Cure Conditions T95 x 160°C		
Hardness, Shore A	66	69
Elongation (%)	392	255
Tensile (MPa)	6.3	7.6
100% Modulus, MPa	1.7	3.1
200% Modulus, MPa	4.0	6.6
300% Modulus, MPa	5.7	-
400% Modulus, MPa	6.3	-

For reference, the following Nordel formulation and data from DuPont Dow Elastomers are provided.

Nordel 1660	100.0
SRF Black	250.0
Thermax® MT N990	100.0
Sunpar 2280	150.0
Whiting	100.0
Zinc Oxide	5.0
Stearic Acid	1.0
Thiuram M	0.6
Butyl Zimate	2.0
Sulfasan R	1.0
Sulphur	0.5
Thiuram E	0.6
Total	**710.7**
Physical Properties - Originals	
Cure 15' @ 160°C	
Tensile Strength	925 psi
Elongation (%)	260
Hardness	78