

Chloroprene Wiper Blade

Windshield wiper blades are an important part of a vehicle due to their critical safety role. Typically, blades are composed of rubber materials such as chloroprene (CR), natural rubber (NR), and/or silicone. The materials should have good mechanical properties, good flexibility at low temperatures, low coefficient of friction, good weathering resistance, good chemical resistance, and high abrasion resistance. In order to achieve all the necessary properties, a mix of rubbers may be used, or coatings or surface treatments may be applied.

The benefits of Thermax® N990CG found in this study include:

- Improved dispersion resulting in a more homogeneous batch of compound. Better dispersion is associated with increased tensile, tear, abrasion, and fatigue properties
- Reduction in compound viscosity which is particularly helpful in improving the processing of high viscosity compounds
- Maintenance of hardness and tensile properties to meet compound specifications
- Extension of compound leading to potential cost savings

The CR formulations can be found in Table 1. Thermax® N990CG replaced furnace black at a ratio of 2.3:1.0 to maintain a compound hardness of 75. Thermax® N990CG is a low PAH grade of N990. If PAH content is not a concern, standard Thermax® N990 can be used in its place. Optical dispersion, MDR, Shore A hardness, tensile, abrasion, and low temperature flexibility tests were run on all compounds. Testing results can be found in the figures on the following pages. The compounding and testing were completed at Akron Rubber Development Lab (ARDL) in Barberton, Ohio.

Table 1. CR formulations

Ingredient	Control	A	B	C
Baypren 214	62	62	62	62
Neoprene WD	30	30	30	30
Budene 1208	8	8	8	8
Spheron 5000A	50	37.5	25	-
Thermax® N990CG	-	29	59	117
TP 90B	10	10	10	10
Struktol WB 222	1.5	1.5	1.5	1.5
ODPA	2	2	2	2
Elastomag 170	4	4	4	4
Stearic Acid	0.5	0.5	0.5	0.5
Kadox 911C	5	5	5	5
ETU 75	1.33	1.33	1.33	1.33
TMTD	1	1	1	1
Sulfur	0.25	0.25	0.25	0.25
Desical P	7	7	7	7
Total	182.58	199.08	216.58	249.58

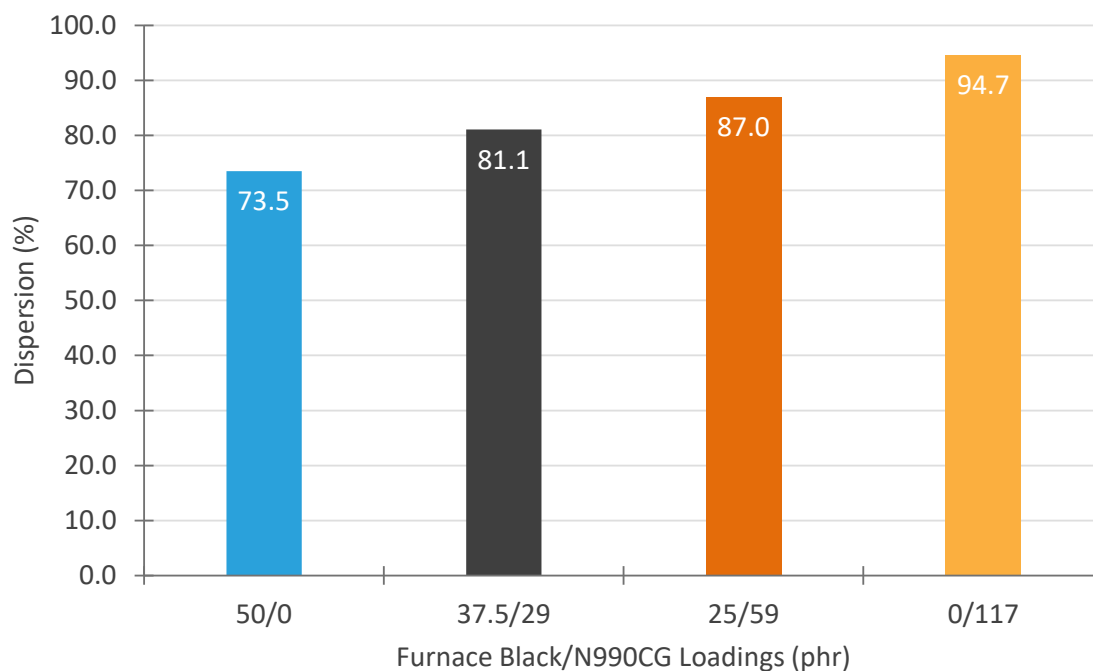


Figure 1. Dispersion of compounds measured by optical microscope. Dispersion improved as N990CG replaced the furnace black.

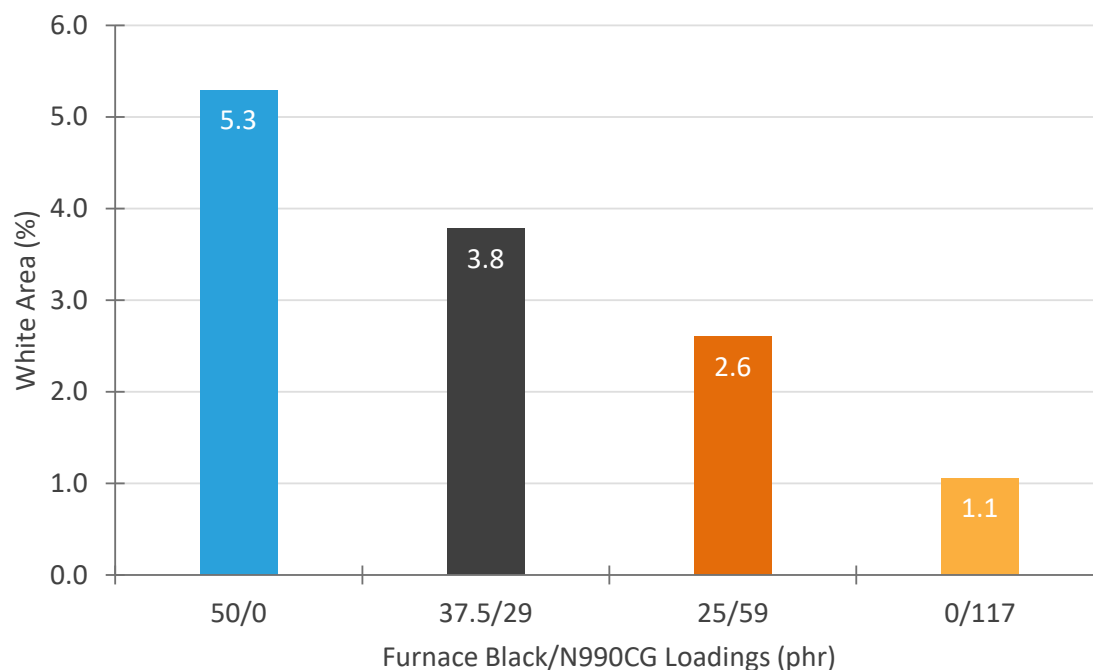


Figure 2. Percent white area of compounds measured by optical microscope. The white area is composed of undispersed agglomerations of carbon black and other ingredients. White area percentage decreased as N990CG replaced the furnace black indicating improved dispersion.

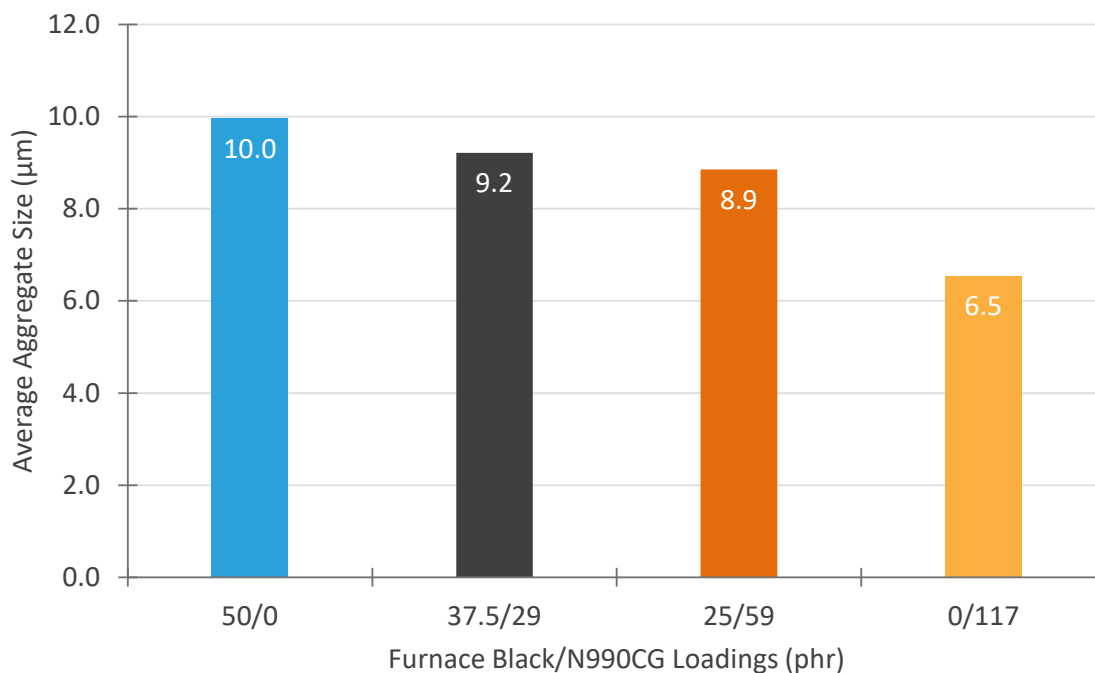


Figure 3. Average aggregate size of compounds measured by optical microscope. This is the average size of agglomerates measured by the instrument. Average size decreased as N990CG replaced the furnace black indicating improved dispersion.

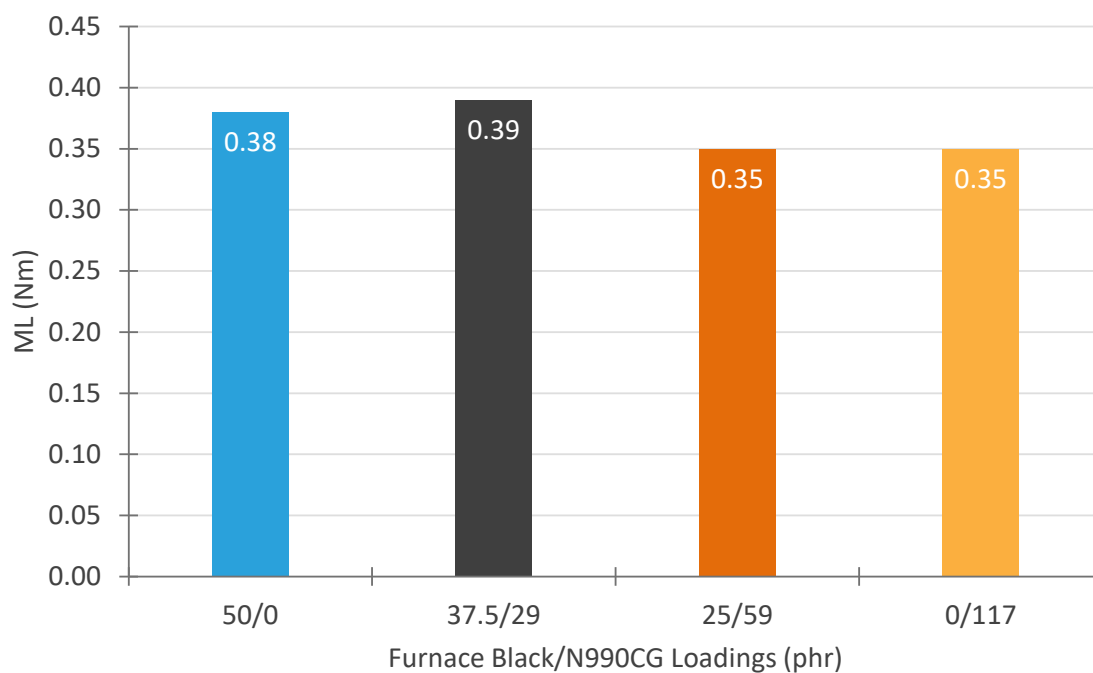


Figure 4. Minimum torque, ML, of compounds measured on MDR at 177°C according to ASTM D5289. Viscosity was lowest for the compounds with greater amounts of N990 due to the low structure of N990CG relative to furnace grades.

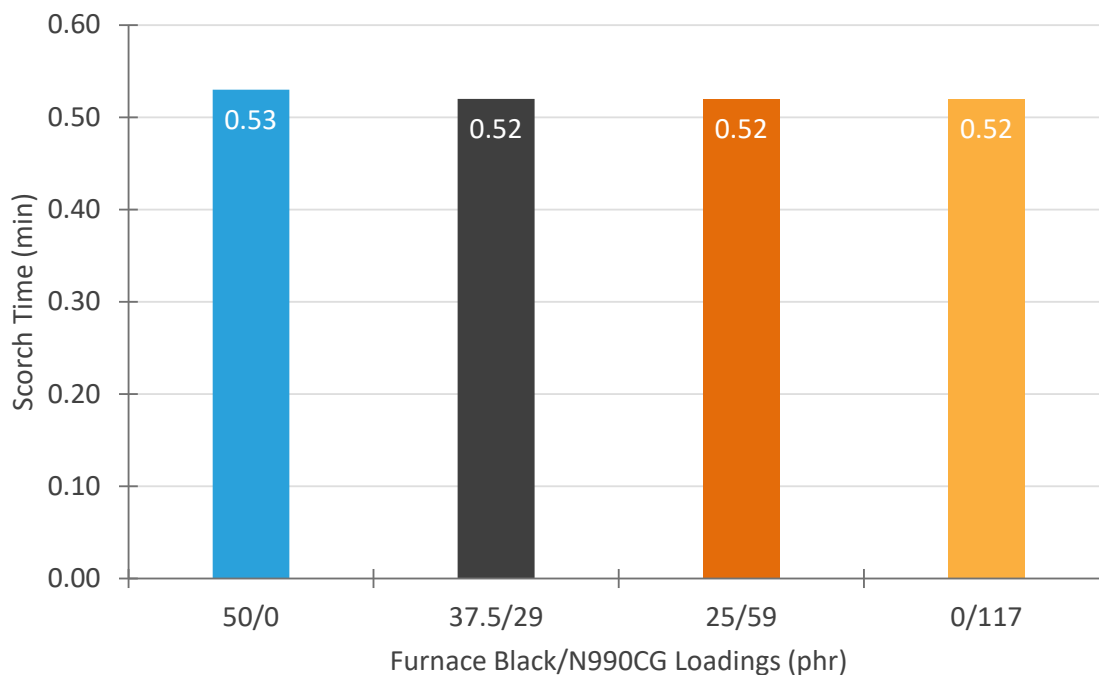


Figure 5. Scorch time, ts1, of compounds measured on MDR at 177°C according to ASTM D5289. There were no significant differences in scorch times.

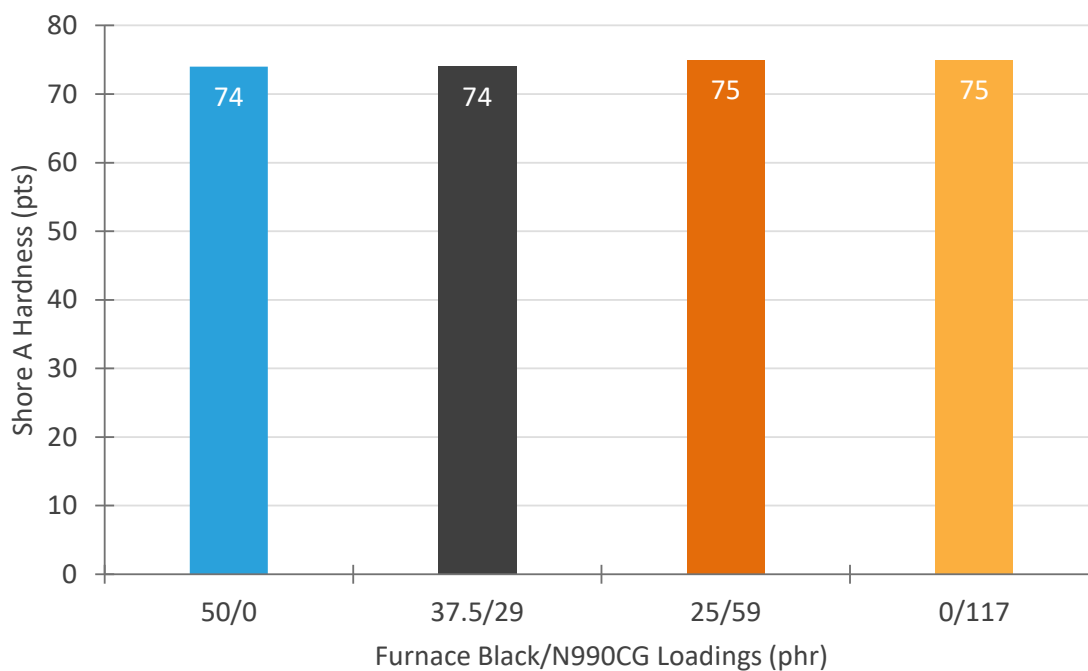


Figure 6. Shore A hardness of compounds measured according to ASTM D2240. All compounds had hardness of 75±3 pts.

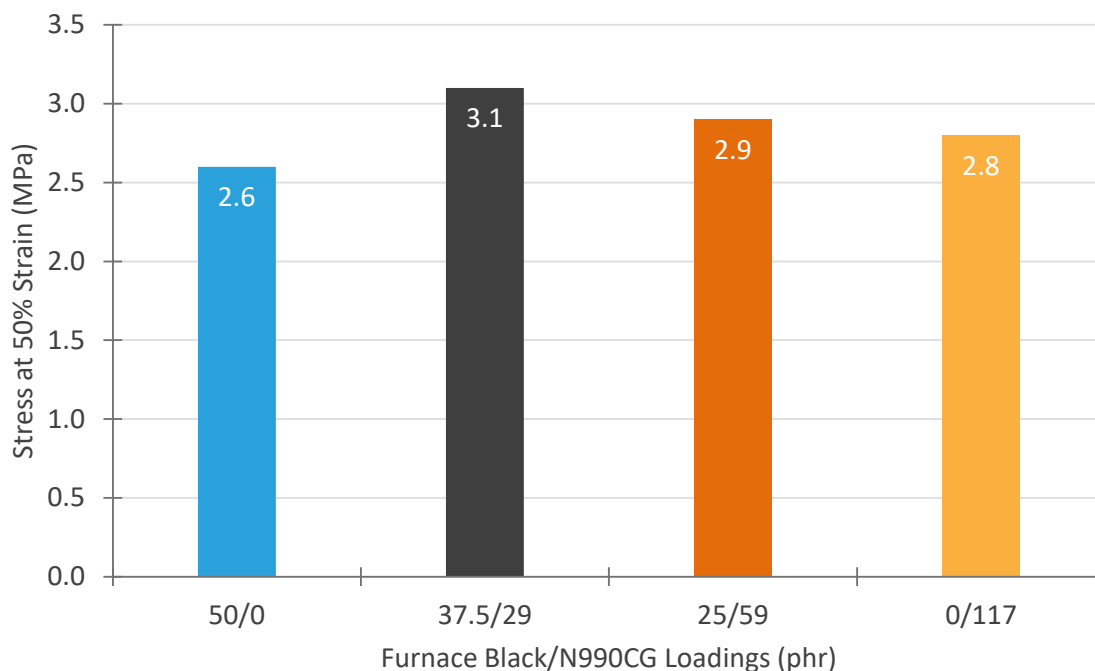


Figure 7. Stress at 50% strain of compounds measured according to ASTM D412. Modulus was higher for the compounds with N990CG due to the higher total filler loading.

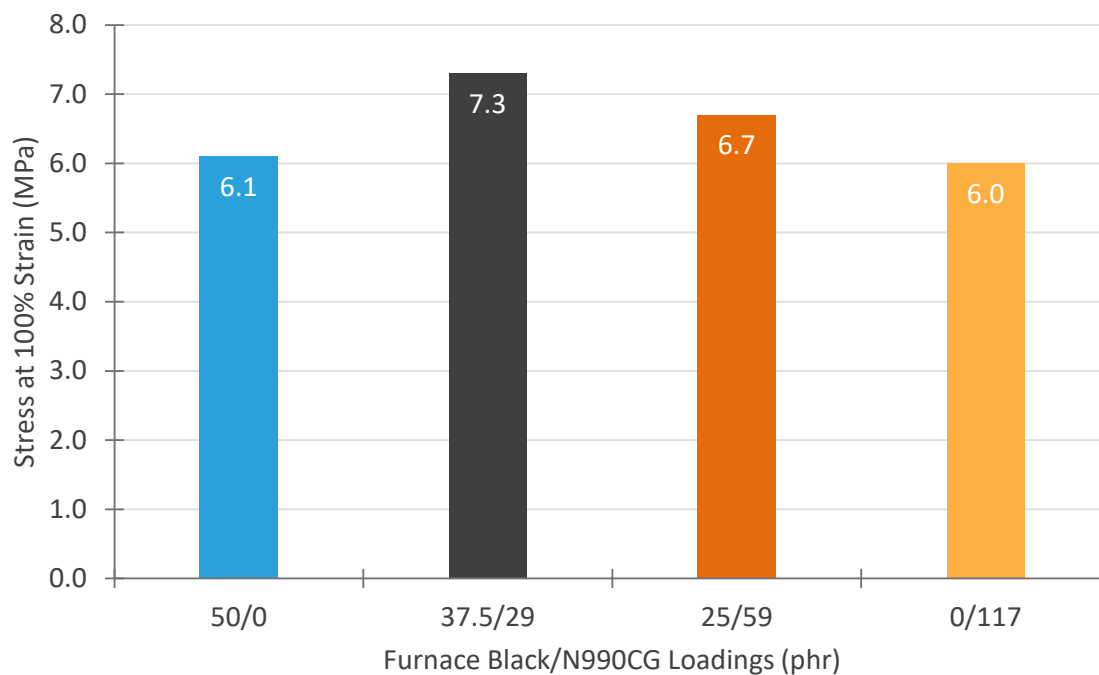


Figure 8. Stress at 100% strain of compounds measured according to ASTM D412. Modulus was higher for the compounds with 25% and 50% furnace black replacement.

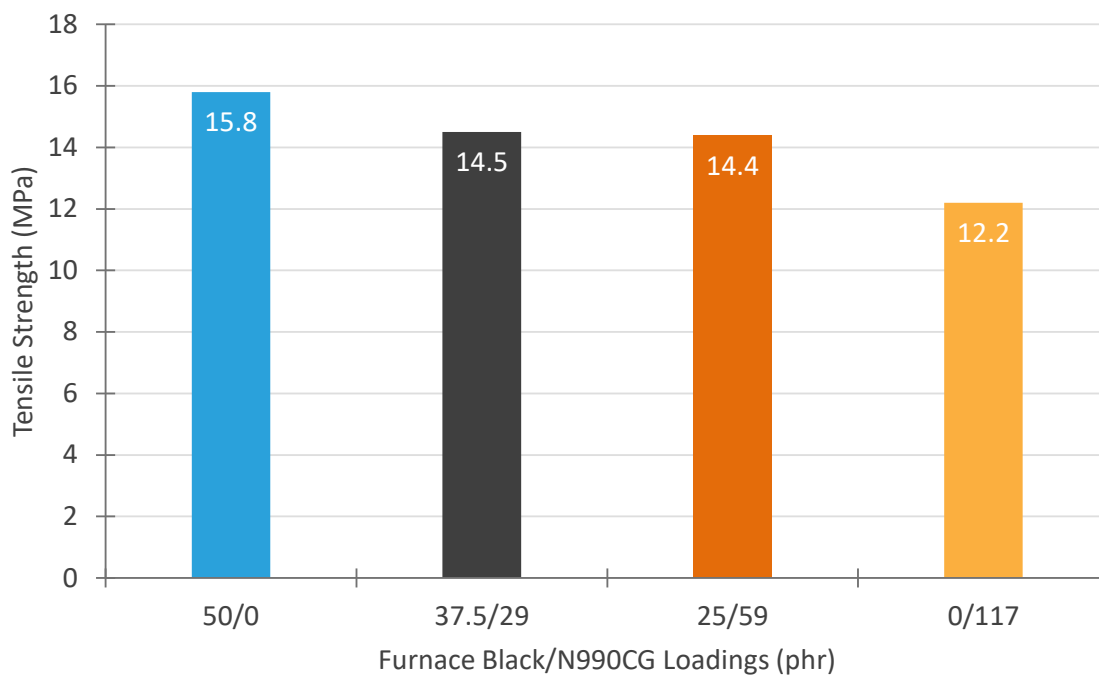


Figure 9. Tensile strength of compounds measured according to ASTM D412. Tensile strength decreased as N990CG replaced furnace black.

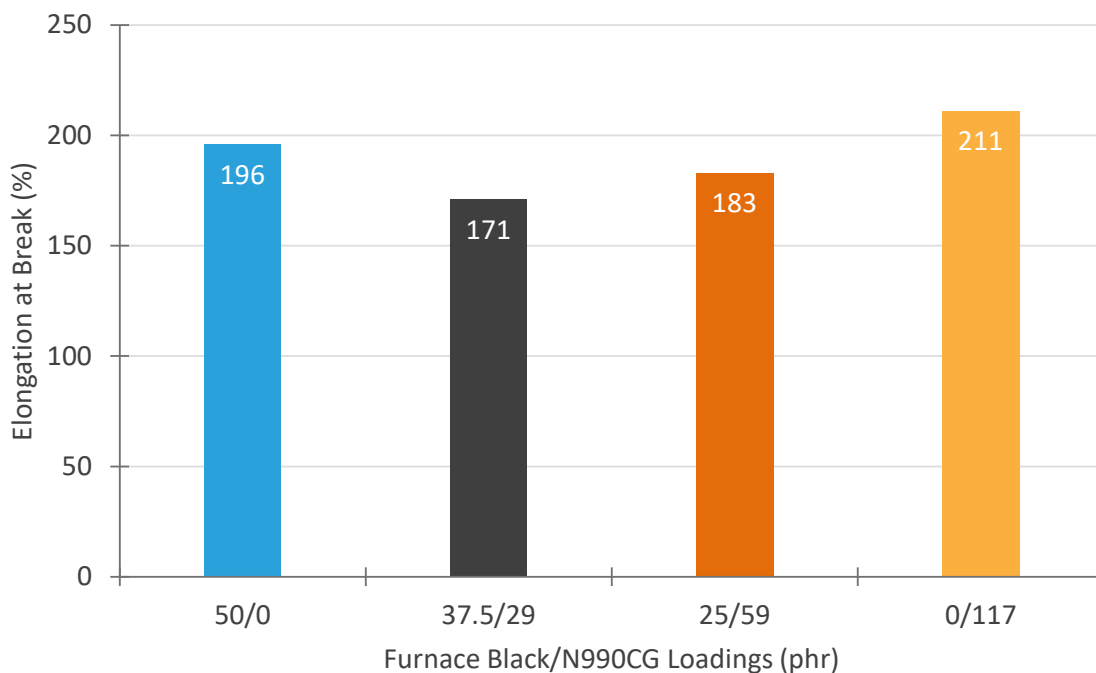


Figure 10. Elongation at break of compounds measured according to ASTM D412. There were no significant differences in elongation between the compounds.

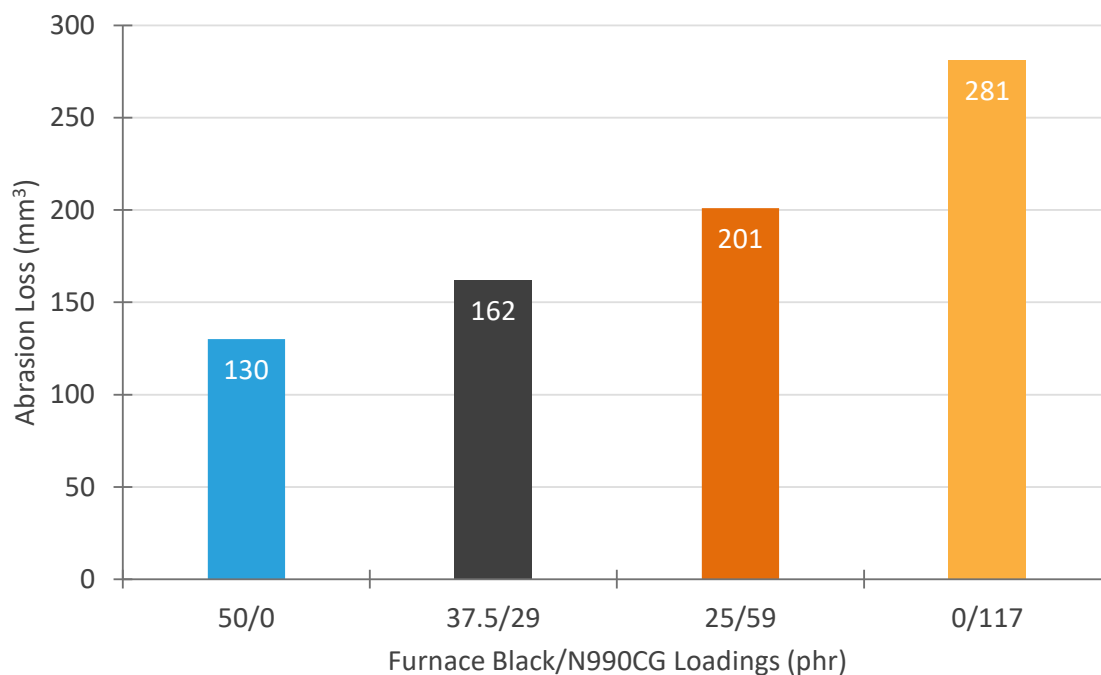


Figure 11. Abrasion loss of the compounds measured according to ASTM D5963. Abrasion resistance decreased as N990CG replaced furnace black.

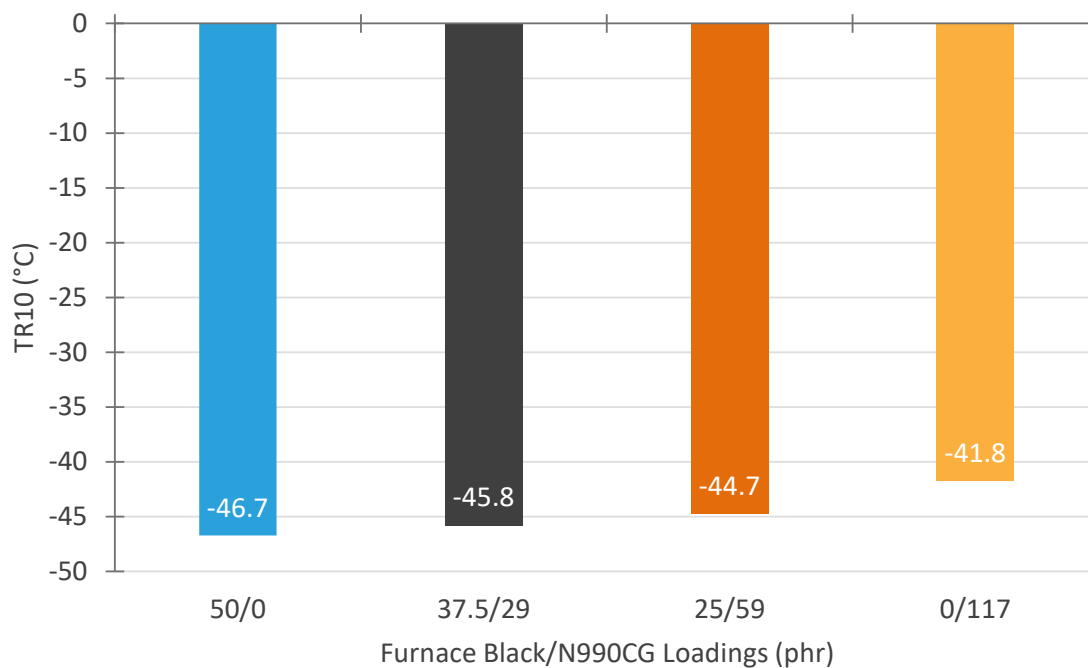


Figure 12. Low temperature retraction values, TR10, of the compounds measured according to ASTM D1329. Specimens were conditioned 10 minutes at 70°C to -73°C in methanol. Slight increase in TR10 as N990CG replaced furnace black.