

Nanbrol® Masterbatch Project Summary (20180115)



This project is intended to illustrate Nanbrol® as an ingredient in an existing compound at about 10 phr nano-fill. The blended compounds use a peroxide cure system, although we tested with both sulfur containing (Nanbrol® 80S) and peroxide optimized (Nanbrol® 80P) masterbatch.

We recommend plasticizers be added after addition of Nanbrol® to your compounds. In this case, the customer received masterbatch pre-mixed with all ingredients, except the cure package, included. Combining soft compound and high fill masterbatch takes skill and practice.

Our partners added MB (Nanbrol® S, Nanbrol® P) to their proprietary compound, during the compounding stage, and per their by-weight calculations, to result in seven mixed compounds;

Control	Run 1	0% Nanbrol®	
8 phr nano-fill	Run 2	~10% Nanbrol®	S
12 phr nano-fill	Run 3	~15% Nanbrol®	S
16 phr nano-fill	Run 4	~20% Nanbrol®	S
8 phr nano-fill	Run 5	~10% Nanbrol®	P
12 phr nano-fill	Run 6	~15% Nanbrol®	P
16 phr nano-fill	Run 7	~20% Nanbrol®	P

The physical testing results for his compounds are very promising. Every significant physical characteristic is improved. The MDR results are as follows;

Nanbrol® S

Run#	ML	MH	ts2	t50	t90	Tan_Delta
1	1.21	35.51	0.38	1.01	3.43	0.045
2	1.03	28.23	0.45	1.13	3.63	0.038
3	1.28	29.19	0.46	1.18	3.96	0.039
4	1.16	25.85	0.49	1.25	4.35	0.037

Nanbrol® P

Run#	ML	MH	ts2	t50	t90	Tan_Delta
1	1.21	35.51	0.38	1.01	3.43	0.045
5	1.87	39.65	0.38	1	3.53	0.050
6	1.96	37.02	0.39	1.01	3.53	0.054
7	1.81	33.49	0.41	1.03	3.5	0.050

Note the Max Torque decreases as nano fill content increases. This effect is most obvious in the sulfur containing version of Nanbrol®. Lower tan delta, as seen in the Nanbrol® S, should relate to lower heat build up, as is desirable in a drive roller application as envisioned here. This data illustrates that using our product as a master batch improves ts2 compared to control. Reduced max torque and slightly extended ts2 should mean easier processing.

Modulus curves for these compounds reinforce the scale of improvement for drive rollers.

Nanbrol® S

Run#	Mod_25	Mod_50	Mod_100	Mod_200
1	398	586	950	1918
2	403	644	1022	1886
3	440	707	1157	2097
4	420	705	1178	2110

Nanbrol® P

Run#	Mod_25	Mod_50	Mod_100	Mod_200
1	398	586	950	1918
5	502	781	1283	
6	522	804	1304	
7	508	807	1331	

It is notable that the increases in modulus values are not uniform. Improvement ranges from 1-40% and we recommend our clients optimize via formulation and fill level experimentation.

Durometer did not change significantly and elongation actually increased with Nanbrol® S. Tear is inconsistent and may reflect difficulty mixing differing viscosity masterbatches on the open mill.

Nanbrol® S

Run#	Tensile	Elongation	Tear	Hardness	Comp_Set	PC Comp Set
1	1834	198	105	79	31.93	30.46
2	2066	223	121	76	36.00	32.18
3	2221	212	108	80	35.57	29.73
4	2432	229	124	79	36.60	29.61

Nanbrol® P

Run#	Tensile	Elongation	Tear	Hardness	Comp_Set	PC Comp Set
1	1834	198	105	79	31.93	30.46
5	1929	164	131	83	35.03	36.93
6	1867	155	130	82	32.37	29.08
7	2107	173	122	84	35.66	31.21

Compression set is minimally changed after post-cure. The roller cure process should most closely duplicate post-cure results.

Abrasion test results show improvement in loss (g) of up to 30%.

Nanbrol® S

Run#	Abrasion Loss (g)	% Improvement
1	1.3	0.00%
2	1.23	5.38%
3	1.19	8.46%
4	0.89	31.54%

Nanbrol® P

Run#	Abrasion Test Result (g)	% Improvement
1	1.3	0.00%
5	1.2	7.69%
6	1.23	5.38%
7	1.03	20.77%

Substituting even small amounts of Nanbrol® in these roller compounds improves them in every way. Customers are encouraged to experiment to find the limits of improvement in their compounds. Some properties improve slowly to a point where they begin to change rapidly.

Samples are available upon request to info@perastic.com.

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