



Luperox[®] HP101XLP

High Performance Grade of Peroxide

Summary

- Luperox[®] HP101XLP is an organic peroxide formulation based on 2,5-dimethyl-2,5-di(t-butylperoxy)hexane that provides significant improvements in scorch time for better flow and elastomer processing. It is suitable for use in a wide variety of elastomers.
- After the cure process, Luperox[®] HP101XLP provides a desirable lower percent compression set @200°C (for FKM elastomers) compared to the standard peroxide grade.
- Luperox[®] HP101XLP provides the benefits of improved part quality (better mold filling) along with improved cured elastomer heat aging & sealing performance.

Introduction

Luperox® HP101XLP was used to cure several grades of FKM. Performance was compared to the conventional peroxide product, Luperox® 101XL45 2,5-dimethyl-2,5-di(t-butylperoxy)hexane on calcium carbonate, 45%-48% assay. Viton® grades evaluated: GBLT-601, GF205-NP, GBL205-LF, GLT-506, GBL-200 and GBF-300.

Luperox® HP101XLP provided significantly improved (lower) percent compression set @ 200°C for 70 hours for all Viton® grades, compared to the standard Luperox® 101XL45 peroxide. In addition longer scorch time values were attained with the “HP” peroxide to provide improved processing and flow characteristics during molding and extrusion operations. In summary, the HP peroxides significantly improve the heat aging characteristics of all these Viton grades evaluated.

Experimental

All of the grades of fluoroelastomer were blended in 80 gram samples on a lab scale C. W. Brabender using the Viton® curing scheme (Table 1 and Table 2) below. After the blending was complete, MDR2000E evaluations were performed at 165°C. We also conducted ASTM D395 compression tests with the compounded elastomer. All compression tests were evaluated using 1.125 inch samples layered to 0.50 inch final thickness. Samples were heat aged at 200°C for 70 hours with a 25% deflection via 0.375" spacers.

Viton® Fluoroelastomer	100 parts	100 parts
N990 Carbon Black	30	30
MgO Acid Acceptor	3	3
TAIC Coagent	3	3
Luperox® 101XL45	3	----
Luperox® HP101XLP	----	3

Table 1: Formulation Used for the Blending of the Viton® Evaluation Grades

Sample 1	Viton® GF300		Sample 1-HP	Viton® GF300
Sample 2	Viton® GF205-NP		Sample 2-HP	Viton® GF205-NP
Sample 3	Viton® GFLT-502		Sample 3-HP	Viton® GFLT-502
Sample 4	Viton® GBL200		Sample 4-HP	Viton® GBL200
Sample 5	Viton® GBL205-LF		Sample 5-HP	Viton® GBL205-LF
Sample 6	Viton® GBLT-601		Sample 6-HP	Viton® GBLT-601
Sample 7	Viton® GLT-506		Sample 7-HP	Viton® GLT-506

Table 2: Sample 1 to 7 use Luperox®101XL45 and Samples 1-HP to 7-HP use Luperox®HP101XLP in the Various Grades of Viton® Fluoroelastomer listed above

Data and Observations

The various grades of Viton[®] provided a maximum torque (M_H) from ~30 to ~40 in-lbs. when using 3 parts of Luperox[®] HP101XLP or the standard Luperox[®] 101XL45 grade. In most instances, Luperox[®] HP101XLP improved the level of crosslinking. Luperox[®] HP101XLP provided significant scorch-protection and higher crosslinking efficiency in all the Viton grades, except for the GF300 grade. In that case, the GF300 had an equal crosslinking efficiency when compared to the standard Luperox[®] 101XL45 grade.

Minimum torque, M_L , which relates to the elastomer viscosity at test temperature, ranged from a low of 0.69 in-lbs. to 3.66 in-lbs. In most instances, the HP peroxide provided lower minimum torque values. Thus, Luperox[®] HP101XLP provided improved elastomer flow properties as the minimum viscosities (M_L) decreased.

MDR cure temperature at 165°C was found to be optimum to compare the various resins as all the T_{C90} cure times were under five minutes at this temperature. We noted that the Luperox[®] HP101XLP did extend the T_{C90} time but this is not a serious issue, as most manufactures post-cure the Viton[®] as part of the processing step.

We found that Luperox[®] HP101XLP provided a more desirable, (lower) percent compression set @ 200°C for all of the various Viton[®] grades compared to the standard Luperox[®] 101XL45 peroxide. This data clearly demonstrates that Luperox[®] HP101XLP significantly improves the heat aging characteristics of FKM type fluoroelastomers.

	M_H (in-lb)	M_L (in-lb)	$M_H - M_L$	$T_{S0.2}$ (min)	$T_{S0.4}$ (min)	$T_{S1.0}$ (min)	T_{C90} (min)
Sample 1	40.75	1.23	39.52	0.410	0.440	0.490	2.46
Sample 2	36.65	0.79	35.86	0.390	0.420	0.480	1.63
Sample 3	30.36	3.39	26.97	0.400	0.430	0.500	8.07
Sample 4	32.07	1.08	30.99	0.440	0.470	0.540	6.31
Sample 5	31.40	0.91	30.49	0.410	0.460	0.510	3.80
Sample 6	27.33	3.66	23.67	0.420	0.450	0.520	4.83
Sample 7	31.29	3.57	27.72	0.390	0.420	0.490	5.65
Sample 1-HP	40.69	1.10	39.59	0.990	1.180	1.510	6.93
Sample 2-HP	41.28	0.69	40.59	0.680	0.790	0.940	3.46
Sample 3-HP	36.39	3.12	33.27	0.645	0.715	0.880	9.35
Sample 4-HP	34.40	0.97	33.43	0.660	0.730	0.850	6.80
Sample 5-HP	34.12	0.82	33.30	0.630	0.705	0.840	5.82
Sample -6HP	31.89	3.78	28.11	0.630	0.710	0.860	7.59
Sample 7-HP	35.45	3.39	32.06	0.640	0.710	0.860	7.52

Table 3: MDR2000 Results at 165 °C for 30 minutes at 1° arc

	Original Thickness (in)	Final Thickness (in)	% Compression Set
GF300	0.529	0.479	32.47
GF300 (HP101)	0.515	0.471	31.43
GF205-NP	0.500	0.470	24.00
GF205-NP (HP101)	0.489	0.472	14.92
GFLT-502	0.506	0.453	40.46
GFLT-502 (HP101)	0.495	0.452	35.83
GBL200	0.500	0.462	30.40
GBL200 (HP101)	0.475	0.451	24.00
GBL205-LF	0.513	0.470	31.16
GBL205-LF (HP101)	0.495	0.461	28.33
GBLT-601	0.495	0.454	34.17
GBLT-601 (HP101)	0.491	0.457	29.31
GLT-506	0.498	0.461	30.08
GLT-506 (HP101)	0.474	0.447	27.27

Table 4: ASTM D395 Compression Test Results, Performed at 200 °C for 70 Hours at 25% Deflection. Samples were Fully Cured at 165 °C, and then Post-Cured in a Convection oven at 200 °C for 6 Hours.

Summary

- Several grades of fluoroelastomer were crosslinked using Luperox[®] HP101XLP.
- Luperox[®] HP101XLP provided improved (lower) percent compression set @ 200°C for 70 hours for all Viton[®] grades evaluated, compared to the standard peroxide.
- Luperox[®] HP101XLP also provided longer scorch times for improved processing and flow characteristics during molding and extrusion operations.

To receive more information or samples of Luperox[®] HP101XLP please contact Harwick Standard at (330)-798-9300 or email: Orders@HarwickStandard.com or visit www.harwick.com. Thank you!

Arkema Inc., Organic Peroxides R&D
King of Prussia, PA 19406-0936