EG22 Filler Enhancer – Bio-based- COA & Product Photos

GreenThinking

产品名称 (Material Name)：GreenThinking® EG22
包装描述(Packing Description)：25Kg/Bag
发货数量 (Delivery Quantity)：
交货日期 (Delivery Date)：
生产批号 (Batch No.)： PFEG240716B01
检验日期 （Test Date）： 2024-7-17

检测项目 Item	单位 Unit	下线 Limit Lower	上线 Limit Upper	检测结果 Test Result
外观 Appearance	白色			
950℃ 灰分 Ash content	%		0.5	**0.08**
105℃ 加热减量 Heating loss	%		1.5	**0.97**
熔点 Melting point	℃	56	66	**61.1**
判定状态 Conclusion	合格 PASS			

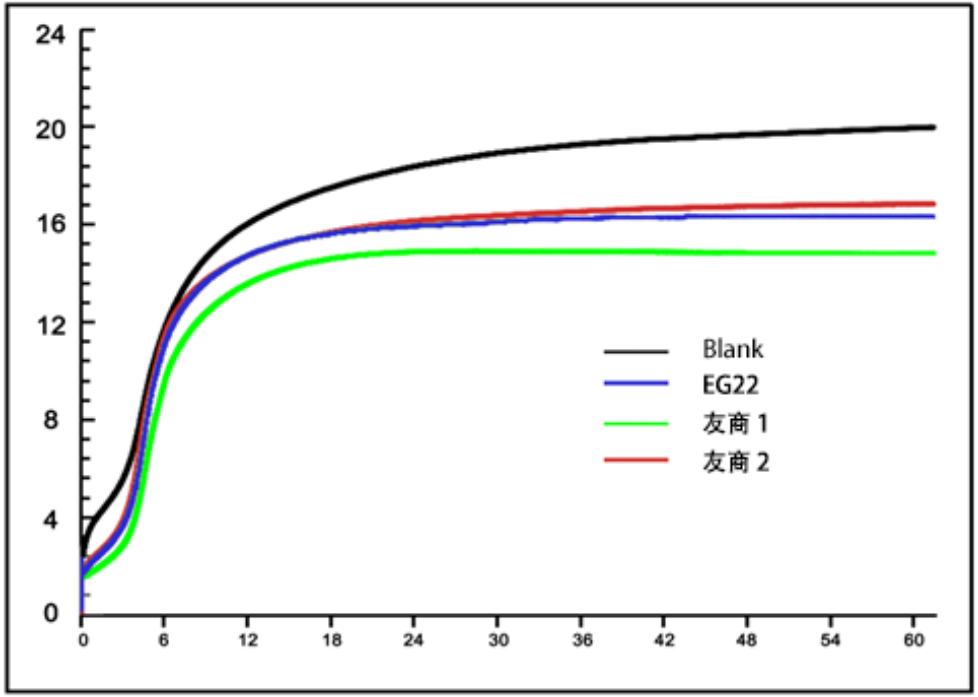
EG22 Filler Enhancer- Experimental Formulation

No.	Material Name	Blank	EG22	Competitor 1	Competitor 2
1	SSBR (Oil-extended, 37.5%)	96	96	96	96
2	BR	30	30	30	30
3	PT702	80	80	80	80
4	N330	6.4	6.4	6.4	6.4
5	SI-69	6.4	6.4	6.4	6.4
6	ZnO	3	3	3	3
7	SA	2	2	2	2
8	RAE Eco-Friendly Oil	10	10	10	10
9	Microcrystalline Wax	1	1	1	1
10	4020	1.5	1.5	1.5	1.5
11	S	1.5	1.5	1.5	1.5
12	DPG	2	2	2	2
13	CZ	1.5	1.5	1.5	1.5
14	EG22 (Bio-based)		4		
14	Competitor 1			4	
14	Competitor 2				4
Total		241.3	245.3	245.3	245.3

EG22 Filler Enhancer- Curing Curve

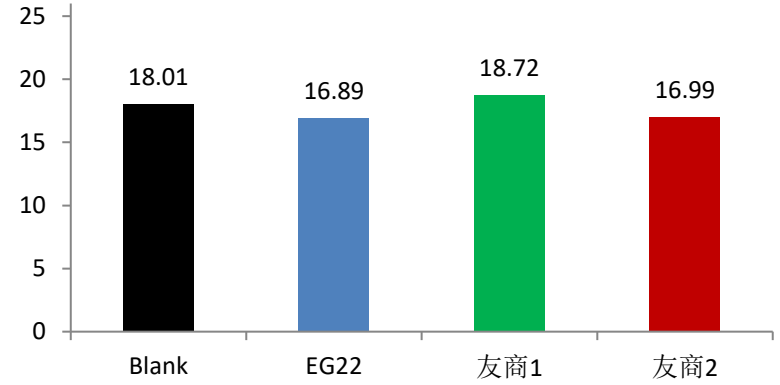
EG22 Vulcanization Characteristics： 160℃ ×60min

Test project	Blank	EG22	Competitor 1	Competito 2
ML(dN.m)	2.46	1.92	1.61	1.86
MH(dN.m)	20.01	17.63	14.95	16.94
T10（**min**）	1.45	2.55	3.19	2.62
T50（**min**)	5.67	5.03	5.4	5.11
T90（**min**)	22.39	12.41	11.91	15.08
TS1（**min**)	0.62	1.85	2.75	1.74
TS2（**min**)	1.81	3.11	3.77	3.01

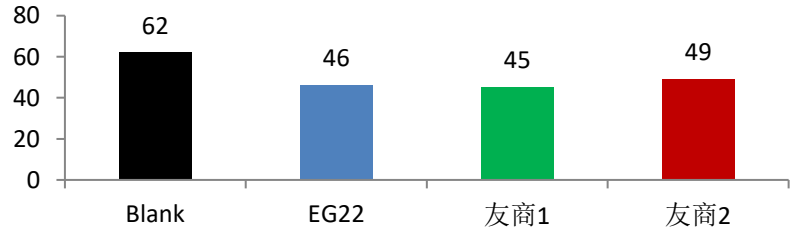


EG22 Filler Enhancer – Payne Effect & Mooney Viscosity

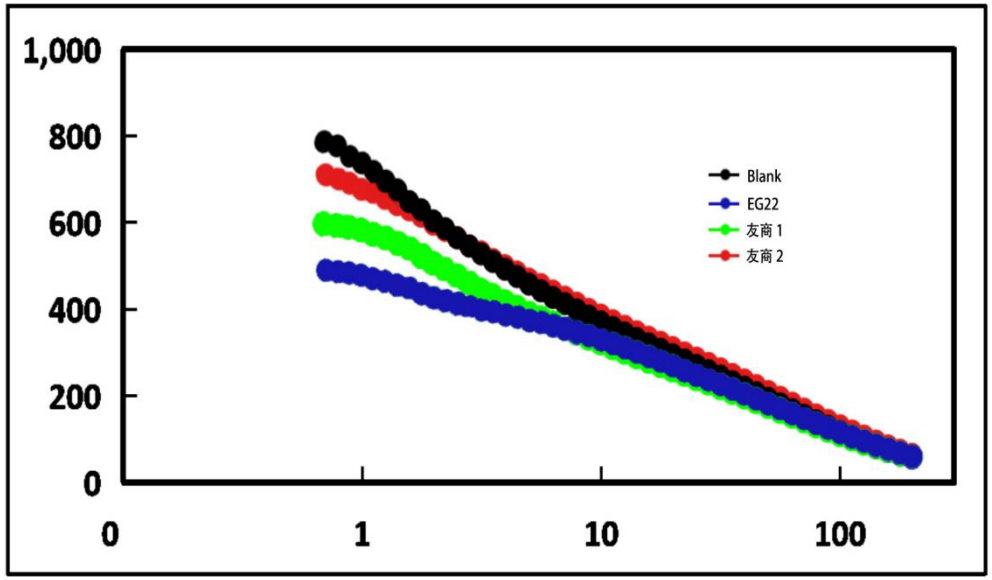
Ts5（min）



Mooney Viscosity ML1+4



RPA Strain Sweep @60°C，G'



EG22：

1. Effectively reduces the Payne effect and enhances rubber performance.
2. Lowers Mooney viscosity, improves silica dispersion and mixing efficiency.

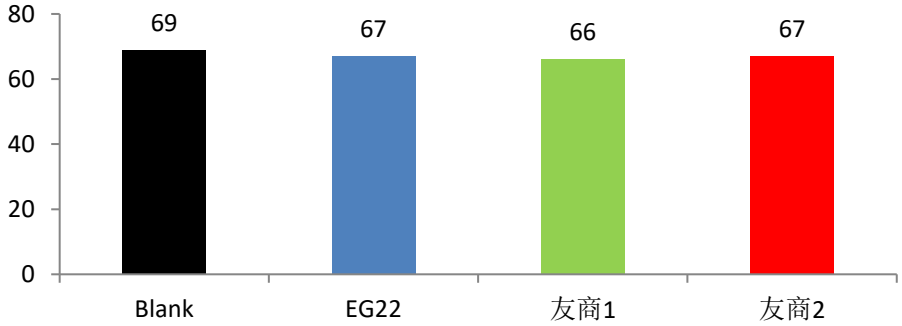
EG22 Filler Enhancer – Pre-Aging Properties

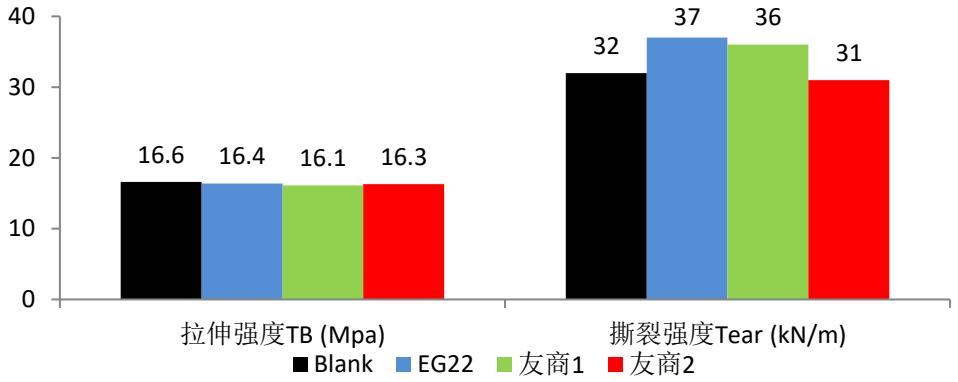
- 试片硫化条件**Curing Condition：** 160℃×30min

Item	Blank	EG22	Competitor 1	Competitor 2
Hardness (Shore A)	69	67	66	67
Tensile Strength (MPa)	16.6	16.4	16.1	16.3
Elongation at Break (%)	422	455	461	422
Tear Strength (kN/m)	32	37	36	31
10% Modulus Mpa	1	0.9	0.7	0.9
30% Modulus Mpa	1.3	1.3	1.2	1.3
50% Modulus Mpa	1.7	1.5	1.3	1.4
100% Modulus Mpa	2.9	2.8	2.5	2.6
300% Modulus Mpa	11.4	10.6	10.1	10.9

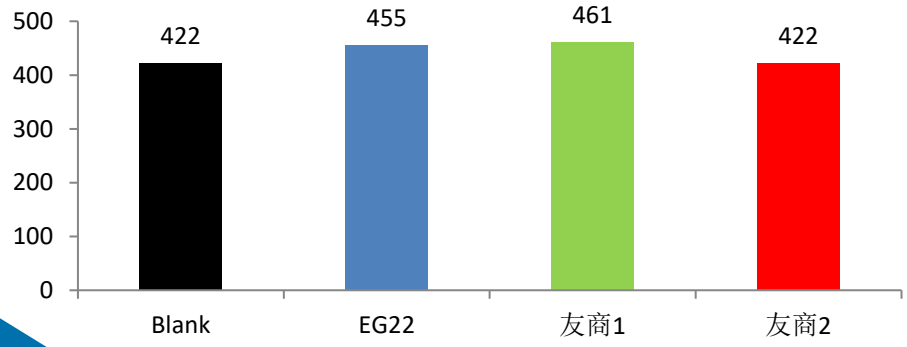
EG22 Filler Enhancer – Pre-Aging Properties

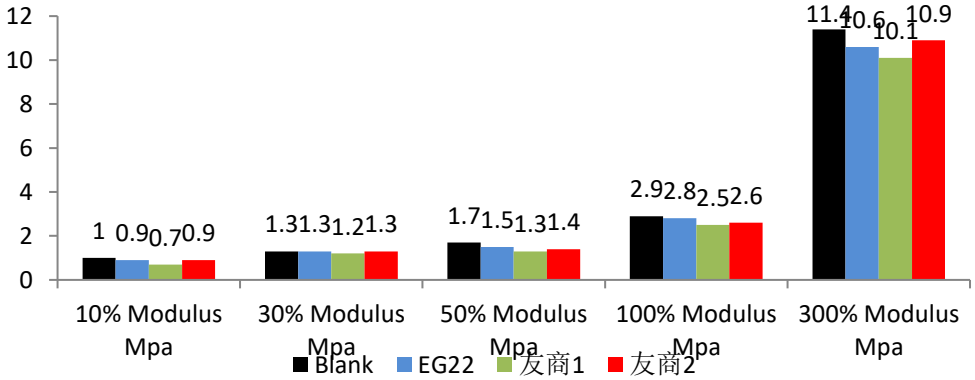
Hardness（Shore A）





Elongation at Break EB (%)





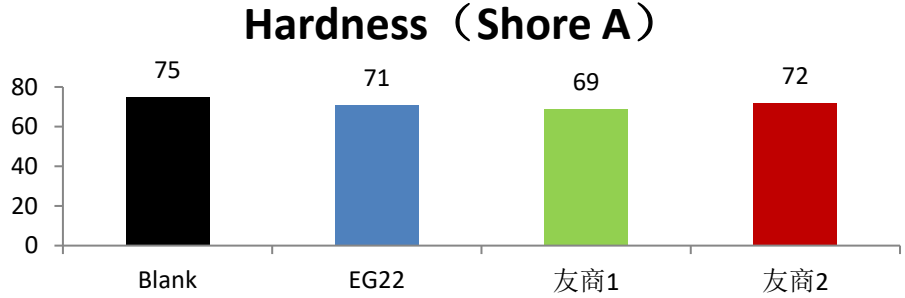
EG22 Filler Enhancer – Post-Aging Properties

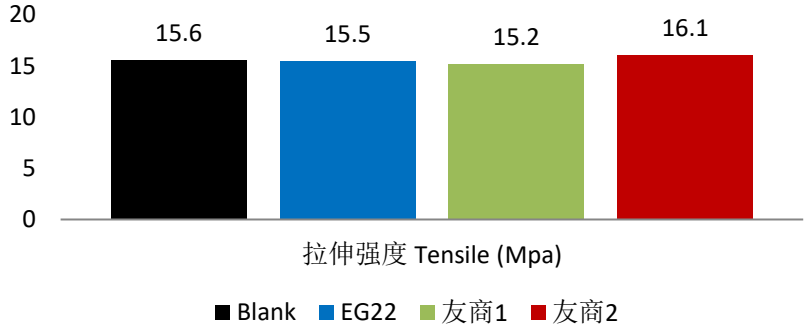
- 试片硫化条件**Curing Condition**：160℃×30min
- Aging Condition Aged：100℃×48h

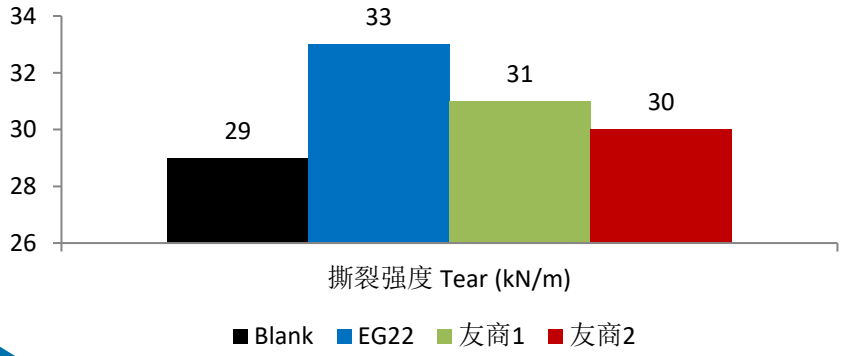
Test Item	Blank	EG22	Competitor 1	Competitor 2
Hardness (Shore A)	75	71	69	72
Tensile Strength (MPa)	15.6	15.5	15.2	16.1
Elongation at Break (%)	307	339	327	314
Tear Strength (kN/m)	29	33	31	30
10% Modulus Mpa	1.2	1.1	0.8	0.9
30% Modulus Mpa	1.9	1.6	1.4	1.4
50% Modulus Mpa	2.5	2.2	2	2.1
100% Modulus Mpa	4.4	3.9	3.3	3.4
300% Modulus Mpa	13.2	14.1	13.4	14.7

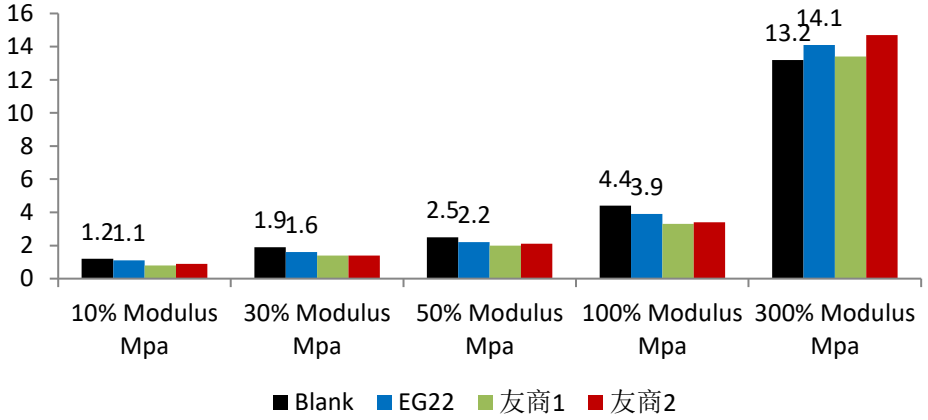
EG22 Filler Enhancer – Post-Aging Properties

- **EG22 demonstrates positive improvements in aging resistance of physical properties, while maintaining the highest tear strength performance.**



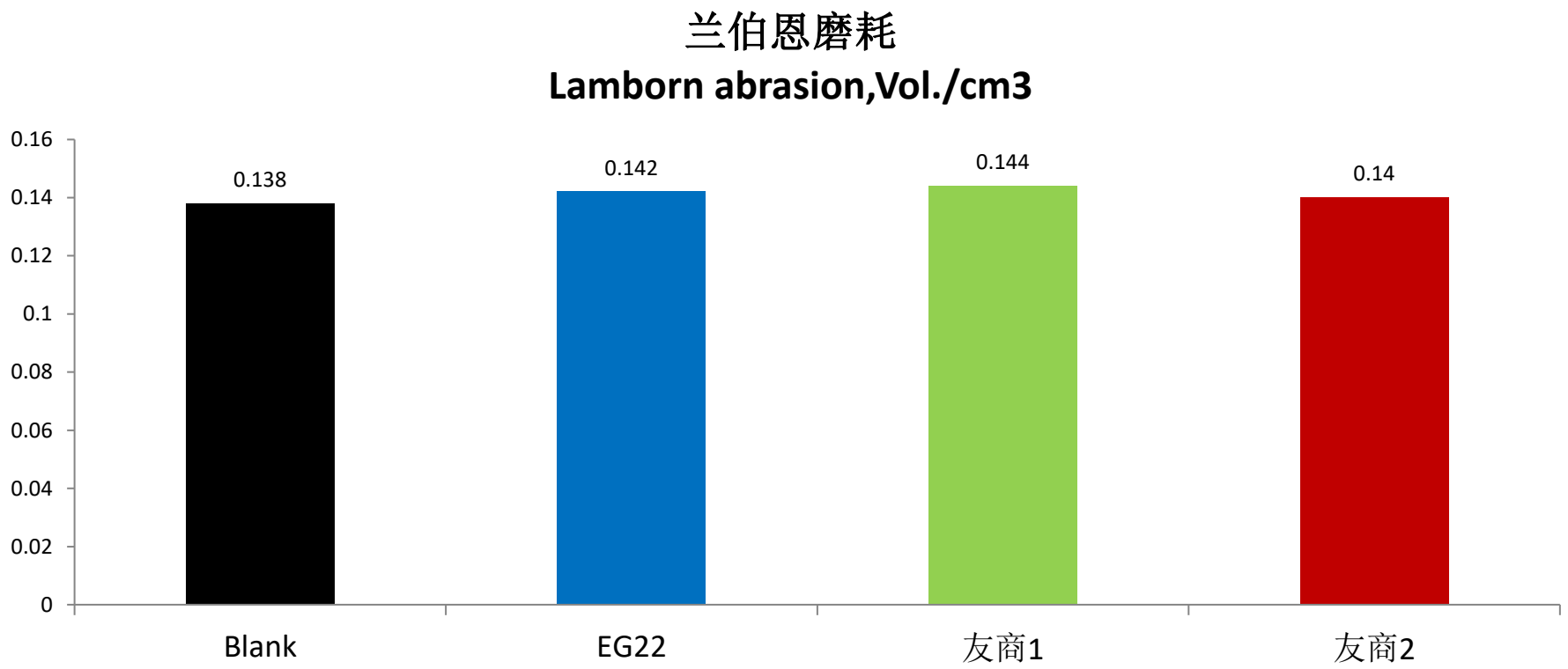






EG22 Filler Enhancer – Lambourn Abrasion

- EG22 exhibits negligible impact on abrasion resistance.

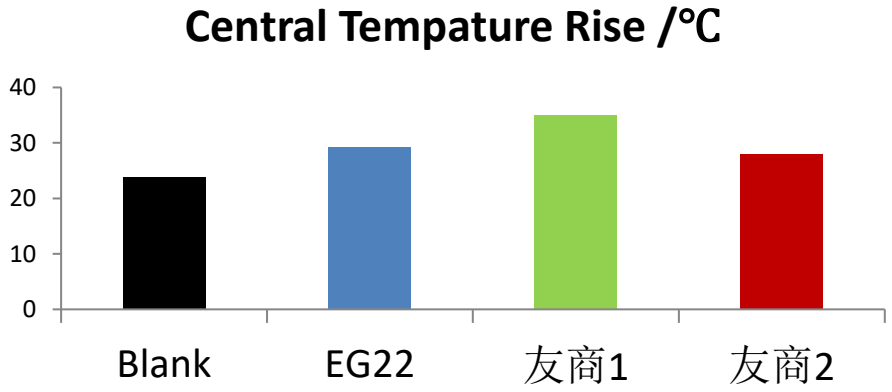


EG22 Filler Enhancer – Compression Heat Buildup

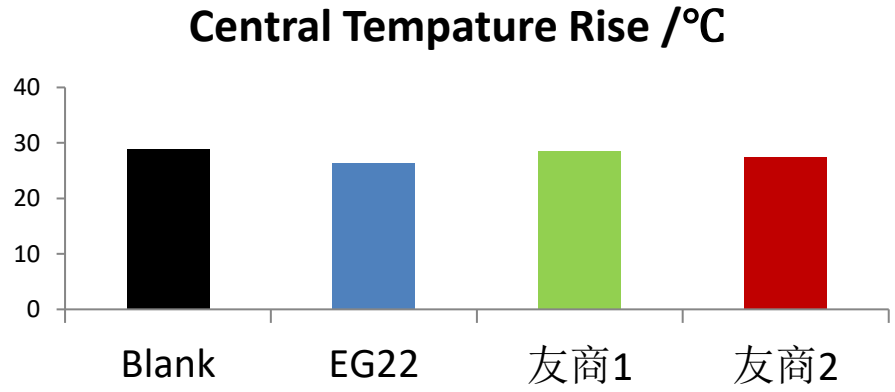
Constant Stress： The addition of 4phr results in decreased hardness (Hs), greater deformation, and higher heat buildup compared to the blank sample; reducing plasticizer oil content appropriately can mitigate heat generation.

Constant Strain： EG22 demonstrates effective reduction in compression heat build-up under constant strain conditions.

定应力 Constant Stress： 700N



定应变Constant Strain： 3.0mm

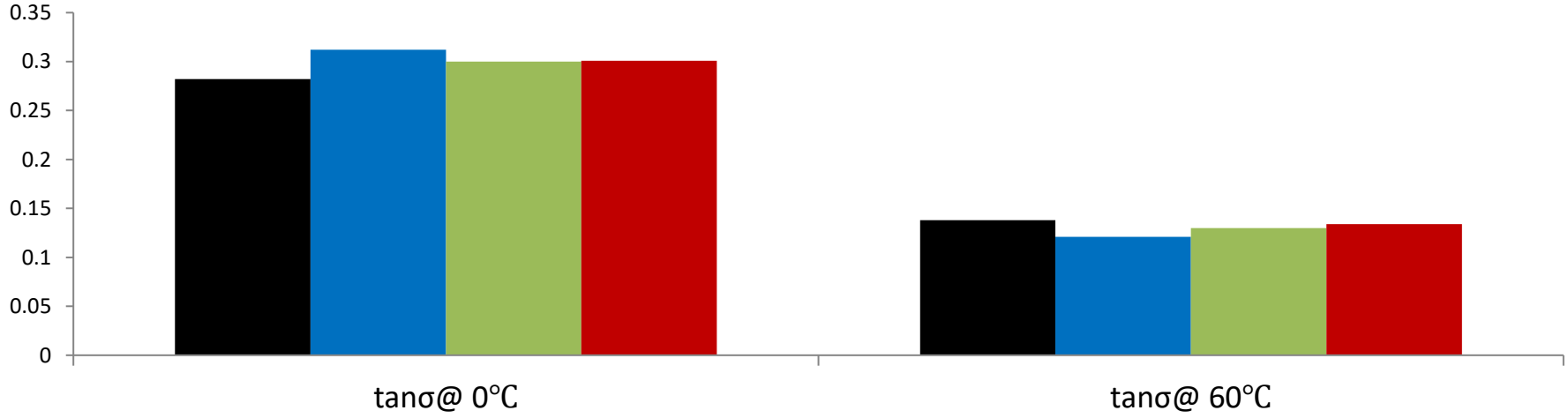


Heat Build Up

vulcanization conditions :150℃×30min, with an initial temperature of 55℃, 30-minute preheating, 25-minute testing, 100N static load, and 10Hz frequency.

EG22 Filler Enhancer – DMA Dynamic Performance

➢ **EG22： Optimal Dynamic Performance：Highest Wet Grip （11% ）↑、Lowest Rolling Resistance （14% ）↓**



Item	Temp.	Blank	EG22	友商1	友商2
E'	0℃	32.38	25.3	29.91	33.92
	60℃	12.41	11.39	11.56	11.48
tanσ	0℃	0.282	0.312	0.3	0.301
	60℃	0.138	0.121	0.13	0.134

➢ **动态性能 DMA Conditions：**

10Hz, Preload 5%，Dynamic strain 0.25%，-80℃ ~100℃，3℃/min

LC Series Bio-Based Functional Modifiers – Reduce Rolling Resistance / Enhance Wet Grip / Improve Wear Resistance – Lower CO_2 Emissions

LC25, LC25T, and other LC series bio-based functional modifiers are 100% plant-derived additives. Their primary components include modified nano-lignin and nano-cellulose, which employ a multi-level structural design (nano-sizing, functionalization, supramolecular assembly) to deliver synergistic effects in rubber compounds. These materials enhance rubber-filler interactions, optimize dynamic performance, reduce heat buildup, and improve wear and aging resistance. They significantly boost tire wet grip, rolling efficiency, and durability. Their natural porous structure and active functional groups can partially replace silica/carbon black while maintaining mechanical strength and reducing compound density, supporting low-carbon, energy-efficient green tire design.

Key Performance Benefits:

- **Reduced Rolling Resistance:**
  The low density and softness of LC modifiers decrease tire rolling resistance, improving fuel efficiency. This contributes to lower vehicle energy consumption and reduced emissions.

- **Enhanced Wet Grip:**
  The rigid aromatic ring structure restricts polymer chain mobility, while nano-scale surface protrusions increase contact points with wet roads, effectively improving wet grip.

- **Lower Heat Buildup:**
  Under dynamic strain, LC modifiers facilitate molecular slippage and reorganization, reducing internal friction heat generation and extending tire service life.

- **Improved Heat Resistance:**
  The phenolic hydroxyl groups effectively scavenge free radicals generated during thermal, oxidative, and dynamic fatigue processes, interrupting oxidation chain reactions. They also decompose hydroperoxides, delaying tire compound hardening, cracking, and performance degradation.

- **Increased Wear Resistance:**
  LC modifiers enhance tear and cut resistance, reducing tread wear and prolonging tire lifespan.

- **Sustainability & Lightweighting:**
  Sourced from renewable materials with excellent biodegradability. Their high strength-to-weight ratio enables lighter tires, reducing energy consumption and carbon emissions.

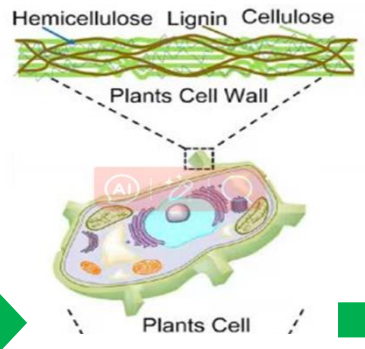
➢ Application Guidelines

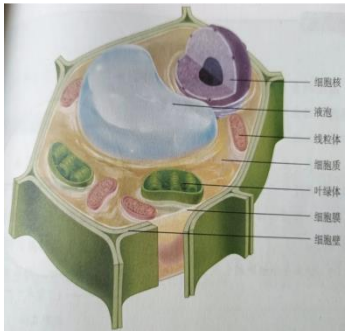
• **Incorporation Method**: LC bio-based modifiers are typically added during the first mixing stage alongside silica/carbon black.

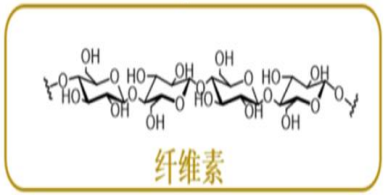
•**Recommended Dosage**: **5–30 phr** (adjust based on processing requirements and performance targets).

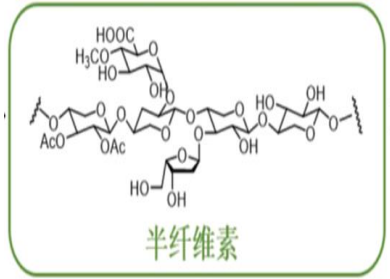
LC Series – Industrial Chain & Product Photos

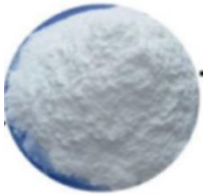
天然植物资源











LC25
Bio-Based
Functional Modifiers

LC Series – Experimental Formulation

Material	Blank	LC25	LC25T	LC25	LC25T
BR	20	20	20	20	20
SBR1723	34.4	34.4	34.4	34.4	34.4
SSBR	55	55	55	55	55
Silica	120	110	110	100	100
LC25		10		20	
LC25T			10		20
SI69	9.6	9.6	9.6	9.6	9.6
N234	5	5	5	5	5
Plasticize	5	5	5	5	5
PR383	16	16	16	16	16
StearicAcid	2	2	2	2	2
4020	2.5	2.5	2.5	2.5	2.5
TMQ	1.5	1.5	1.5	1.5	1.5
Wax	2	2	2	2	2
DP20W	2	2	2	2	2
ZINC OXIDE	3	3	3	3	3
DPG(D)	0.5	0.5	0.5	0.5	0.5
SULFUR	1.3	1.3	1.3	1.3	1.3
TBzTD-70	0.3	0.3	0.3	0.3	0.3
TBBS	1.15	1.15	1.15	1.15	1.15

LC Series – Curing Characteristics

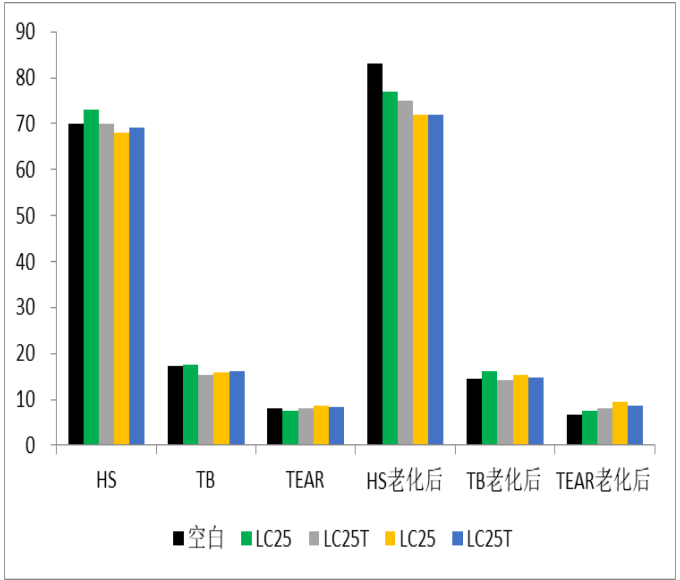
- LC25/25T show minimal impact on vulcanization rate. The increased T35-T5 interval indicates improved processing safety, with higher Mooney viscosity observed.

Material		Blank	Blank	LC25-10	LC25T-10	LC25-20
160*15min	ML	5.0	5.9	4.3	4.6	4.3
	MH	17.1	19.1	15.5	12.6	14.8
	MH-ML	12.2	13.2	11.2	7.9	10.5
	T10	0.59	0.92	0.99	2.36	2.23
	T50	4.38	4.81	5.49	5.46	5.77
	T90	10.29	10.74	11.17	11.32	11.45
	T90-T10	9.70	9.82	10.18	8.96	9.22
	TS1	0.47	0.62	0.83	2.62	2.13
	TS2	1.63	1.72	2.53	3.66	3.27
Mooney/100 ℃	ML1+4	119.90	136.70	117.30	127.20	125.50
Scorch/125 ℃	T5	13.23	12.78	19.46	13.57	17.61
	T35	20.99	23.20	31.15	24.89	26.80
	T35-T5	7.76	10.42	11.69	11.32	9.19

LC Series – Pre-Aging Properties

Material		Blank	LC25-10	LC25T-10	LC25-20	LC25T-20
Pre-Aging Properties	HS	70	73	70	68.00	69
	TB	17.4	17.6	15.3	15.8	16.3
	EB	310	330	310	320	320
	M10	1.2	0.9	0.8	0.7	0.8
	M25	1.8	1.5	1.3	1.2	1.3
	M50	2.5	2.2	1.9	2.0	2.1
	M100	4.1	3.9	3.3	3.8	3.9
	M300	16.4	15.3	13.9	14.5	14.7
	TEAR	7.99	7.63	8.01	8.71	8.31
Material		Blank	LC25-10	LC25T-10	LC25-20	LC25T-20
Post-Aging Properties 100*48h	HS	83	77	75	72.00	72
	TB	14.5	16.3	14.3	15.3	14.9
	EB	190	230	230	230	230
	M10	1.73	1.20	1.00	0.70	0.80
	M25	2.70	2.00	1.70	1.40	1.50
	M50	3.80	3.00	2.70	2.60	2.60
	M100	6.70	5.50	4.80	5.30	5.10
	TEAR	6.75	7.54	7.94	9.44	8.55
Post-Aging Property Change Rates 100*48h	HS	13	4	5	4	3
	TB	-16.7%	-7.4%	-6.5%	-3.2%	-8.6%
	EB	-38.7%	-30.3%	-25.8%	-28.1%	-28.1%
	M10	44.2%	33.3%	25.0%	0.0%	0.0%
	M25	50.0%	33.3%	30.8%	16.7%	15.4%
	M50	52.0%	36.4%	42.1%	30.0%	23.8%
	M100	63.4%	41.0%	45.5%	39.5%	30.8%
	TEAR	-58.8%	-50.7%	-42.9%	-34.9%	-41.8%

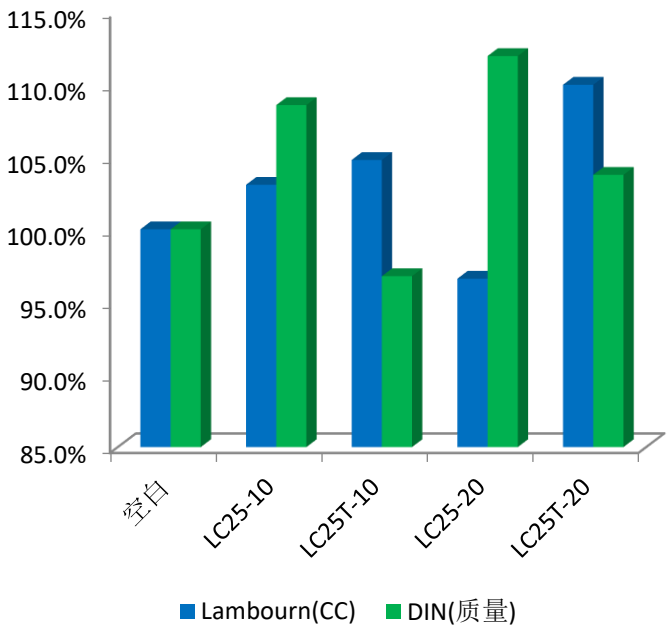
- After adding LC series bio-based functional modifiers, initial properties remain comparable, while tear and aging resistance improve significantly by **10–40%**. ↑



LC Series – Abrasion Resistance

- **Lambourn Test: LG25/25T improves wear resistance by 3–11.9% ↑ (lower Specific Gravity → cost/weight savings).**

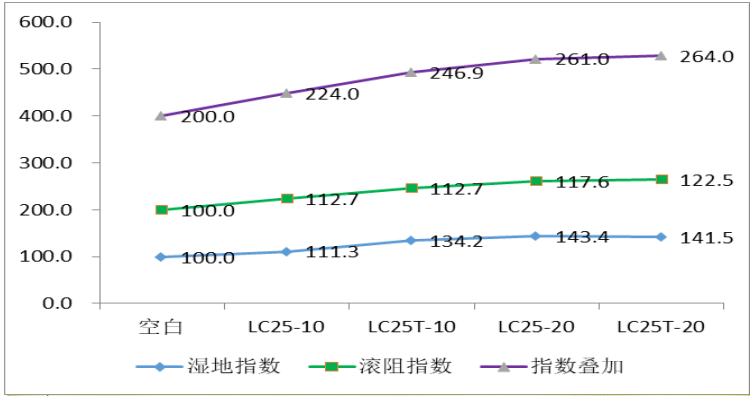
Item	空白	LC25-10	LC25T-10	LC25-20	LC25T-20
Specific Gravity	1.28	1.27	1.27	1.26	1.26
Lambourn(CC)	0.3093	0.3001	0.2952	0.3202	0.2813
DIN(质量)	0.1079	0.0994	0.1115	0.0964	0.1040
Lambourn(CC)	100.0%	103.1%	104.8%	96.6%	110.0%
DIN(质量)	100.0%	108.6%	96.8%	111.9%	103.8%

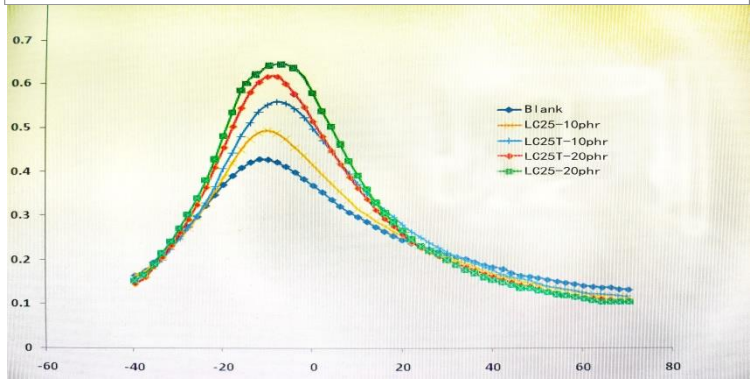


LC Series – DMA Dynamic Performance

➢ **LG25/25T：Optimal Results:Highest Wet grip** 11.3~41.5%↑、**Lowest Rolling resistance**12.7~22.5%↓）

Item	空白	LC25-10	LC25T-10	LC25-20	LC25T-20
Tan&−30℃	0.253	0.253	0.248	0.265	0.261
Tan&0℃	0.371	0.413	0.498	0.532	0.525
Tan&30℃	0.211	0.204	0.213	0.192	0.190
Tan&60℃	0.142	0.124	0.124	0.117	0.110
滚阻指数	100.0	112.7	112.7	117.6	122.5
E’-30℃	819.7	824.1	872.2	826.4	815.3
E’0℃	80.6	66.0	55.5	36.6	39.6
E’30℃	26.4	21.2	15.4	10.3	12.8
E’60℃	16.0	13.7	10.0	7.2	9.0





➢ **动态性能 DMA 测试条件：**

10Hz, Preload 1%，Dynamic strain 0.2%，-24℃ ~105℃，4℃/min