TOSOH

CHLOROPRENE RUBBER

SKYPRENE®

TOSOH CORPORATION

Introduction

Tosoh Corporation was established in 1935. The company's first products were soda ash and caustic soda. In the years that followed, Tosoh gradually added new plants to produce an ever-increasing stream of important industrial chemicals. The technology developed and the experience gained in operating these plants provided the basis for Tosoh's expansion and growth into diverse sectors.

Early in the 1960s, Tosoh entered the organic and petrochemical fields, beginning with its grouping together of a number of firms into a petrochemical complex. The company today has two such complexes in Japan that produce a wide range of products. It also has three well-equipped laboratories in Japan staffed by scientists and engineers who research, develop and provide technical services and advice for the application of Tosoh products.

Nanyo Complex

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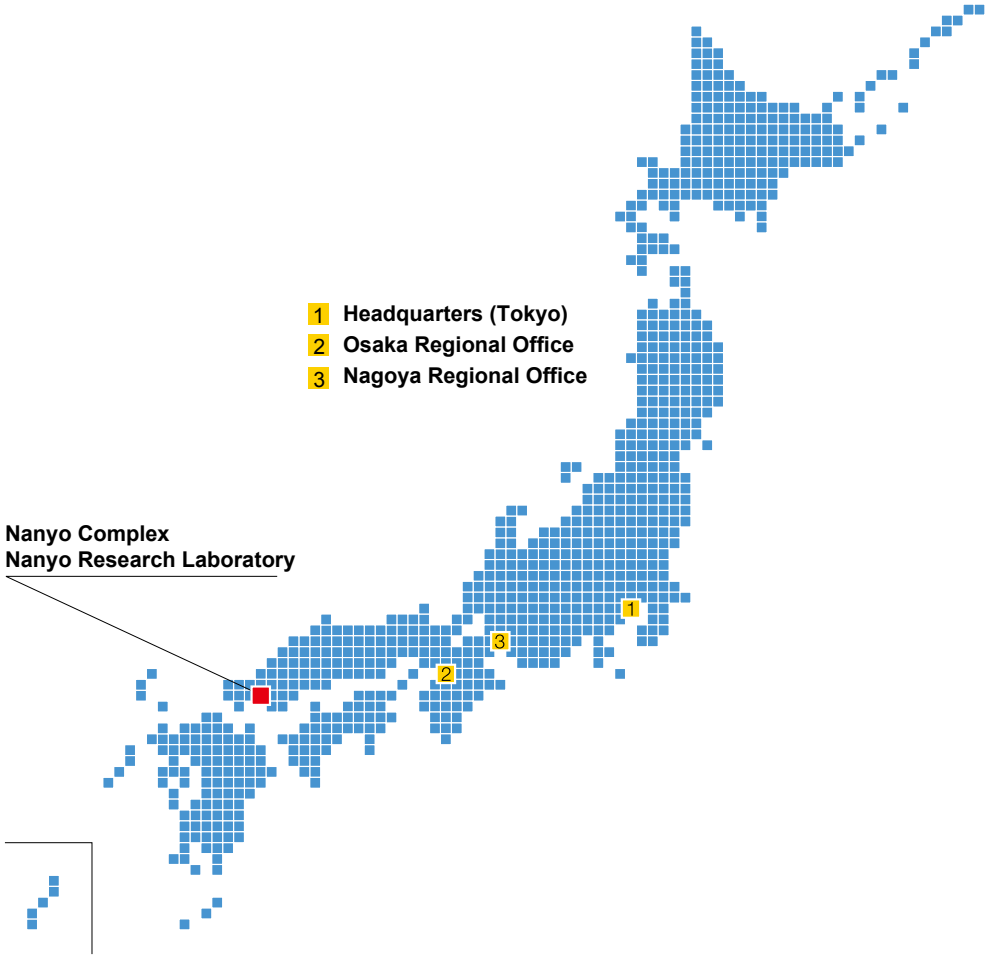


SKYPRENE®

What is "SKYPRENE" ?

Skyprene is Tosoh Corporation's registered brand of chloroprene rubber (CR). This high-quality CR developed, manufactured, and sold by Tosoh, in produced through a combination of chlorination techniques developed by Tosoh over many years. Foremost among the qualities that make Skyprene superior to other CR compounds is its resistance to cold, heat, abrasion, oils, and chemicals. Tosoh boasts a long-standing reputation for consistently high-quality manufacturing, and Skyprene's stability strongly reflects this characteristic.

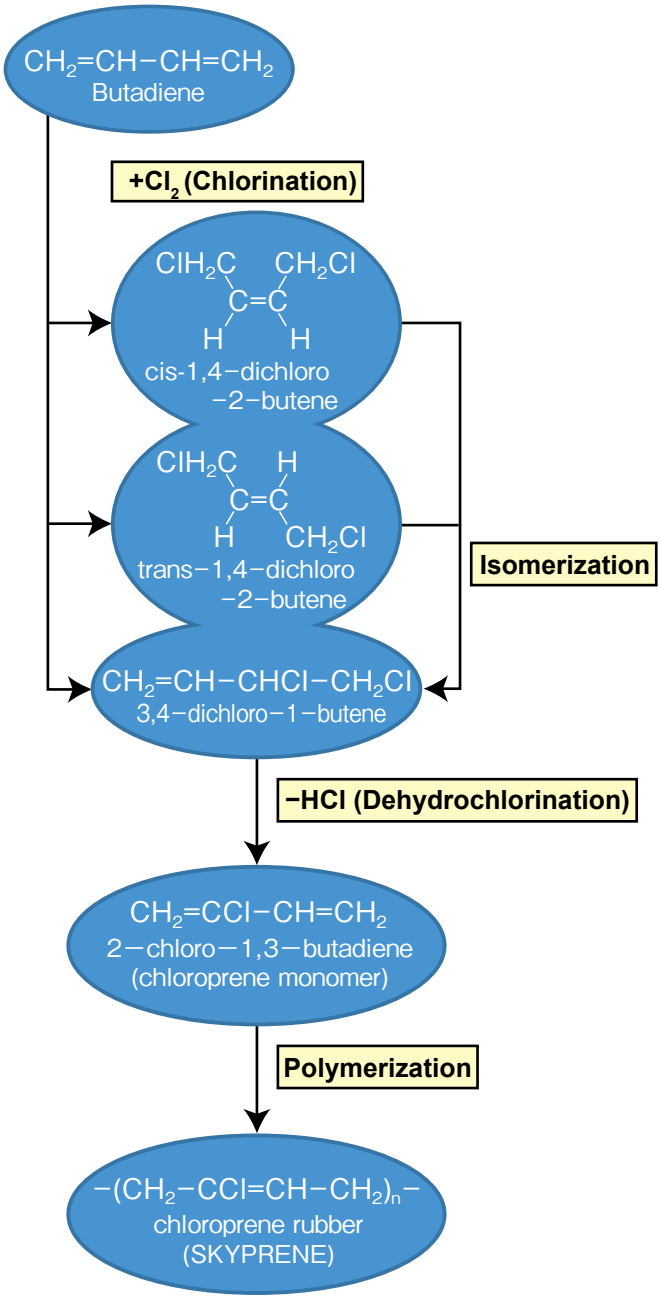
Product safety

The unreacted chloroprene monomer in Skyprene is less than one part per million (<0.0001 % by weight). For additional information, please see SDS (Safety Data Sheet) of Skyprene.

ISO 9001
BUREAU VERITAS
Certification

Skyprene is manufactured under certified ISO-9001 conditions at Tosoh Nanyo Complex

MANUFACTURING PROCESS OF SKYPRENE



Product Grades and Characteristics

Chlorine groups and a uniform molecular structure mean that chloroprene rubber gradually crystallizes at low temperatures. The rate of crystallization depends on the conditions during polymerization. The crystallization rates for Skyprene are indicated in figure-1; a change in hardness occurs at -10℃ .

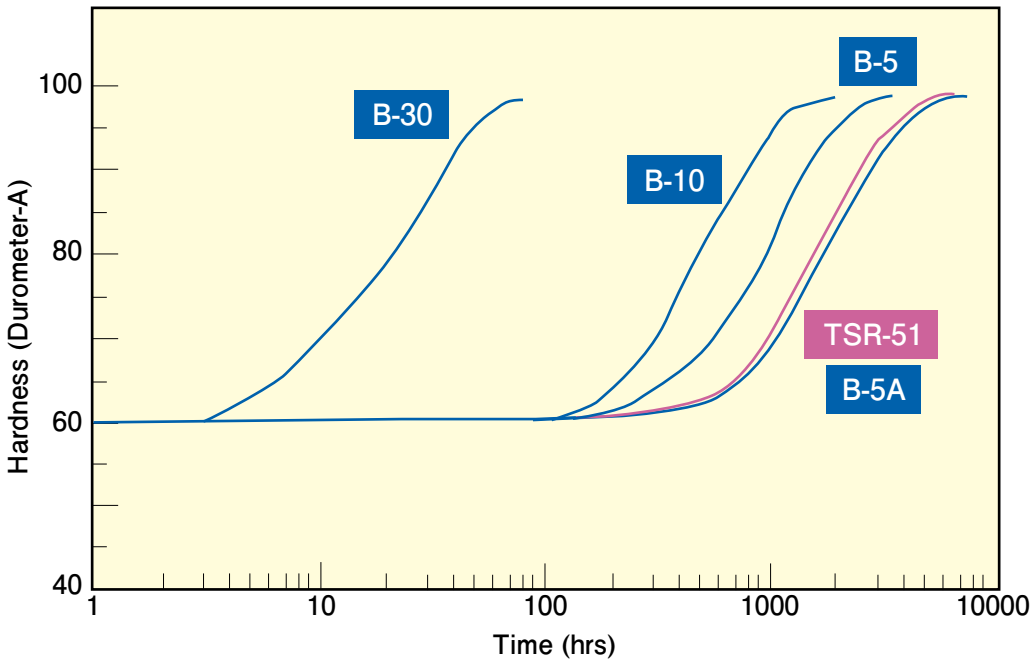


Figure-1 Change in hardness of Skyprene at -10℃
(standard formulation, cured 20 minutes at 150℃)

Product Grades and Characteristics

Skyprene is classified according to the types of modifier that is used;

- **Mercaptan-modified**
  Molecular weight is controlled with mercaptan
- **Xanthogen-modified**
  Molecular weight is controlled with xanthogen
- **Sulfur-modified**
  Molecular weight is controlled with sulfur

Skyprene grades are classified according to the range of mooney viscosity and the range of crystallization rate as indicated figure-2.

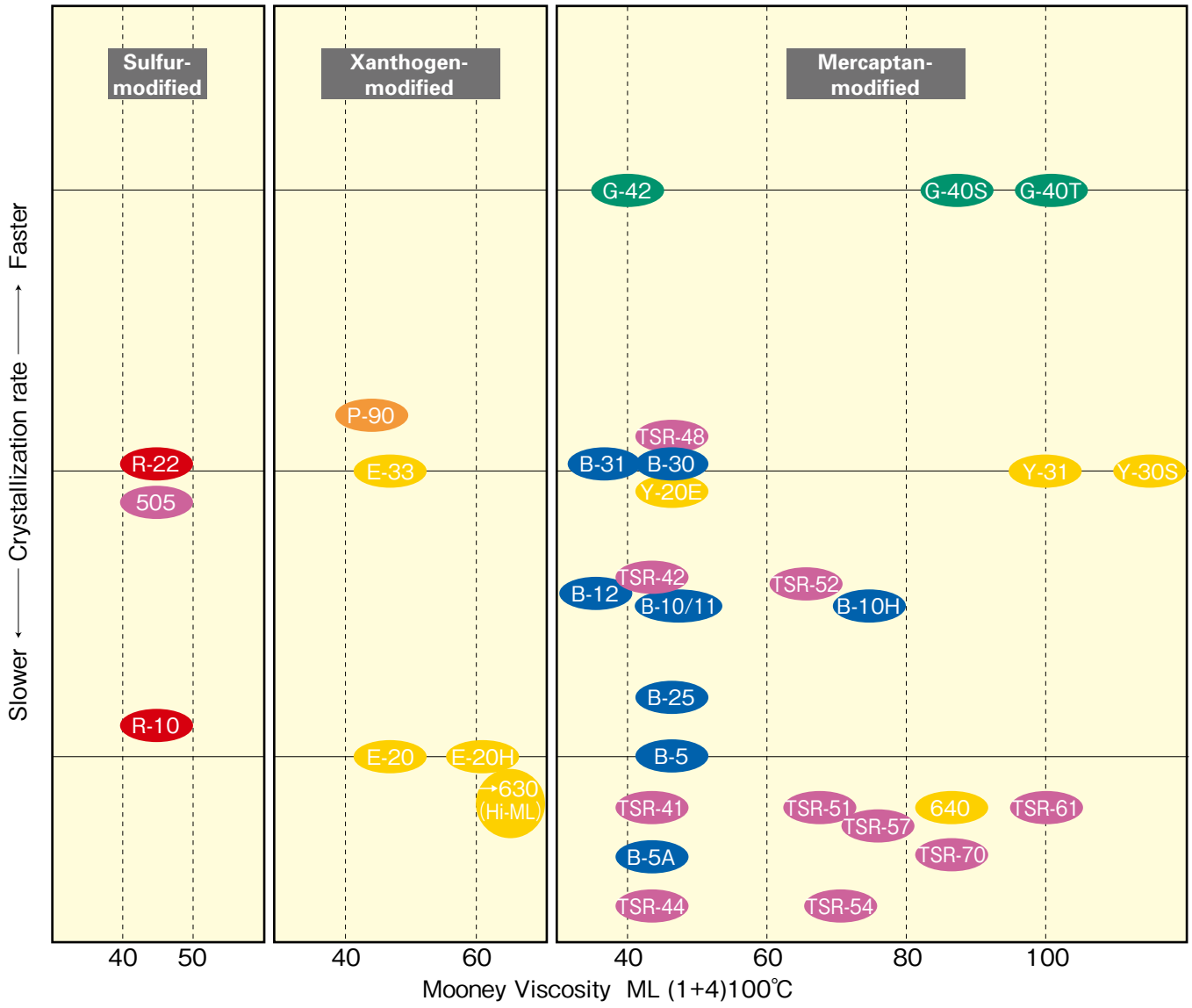
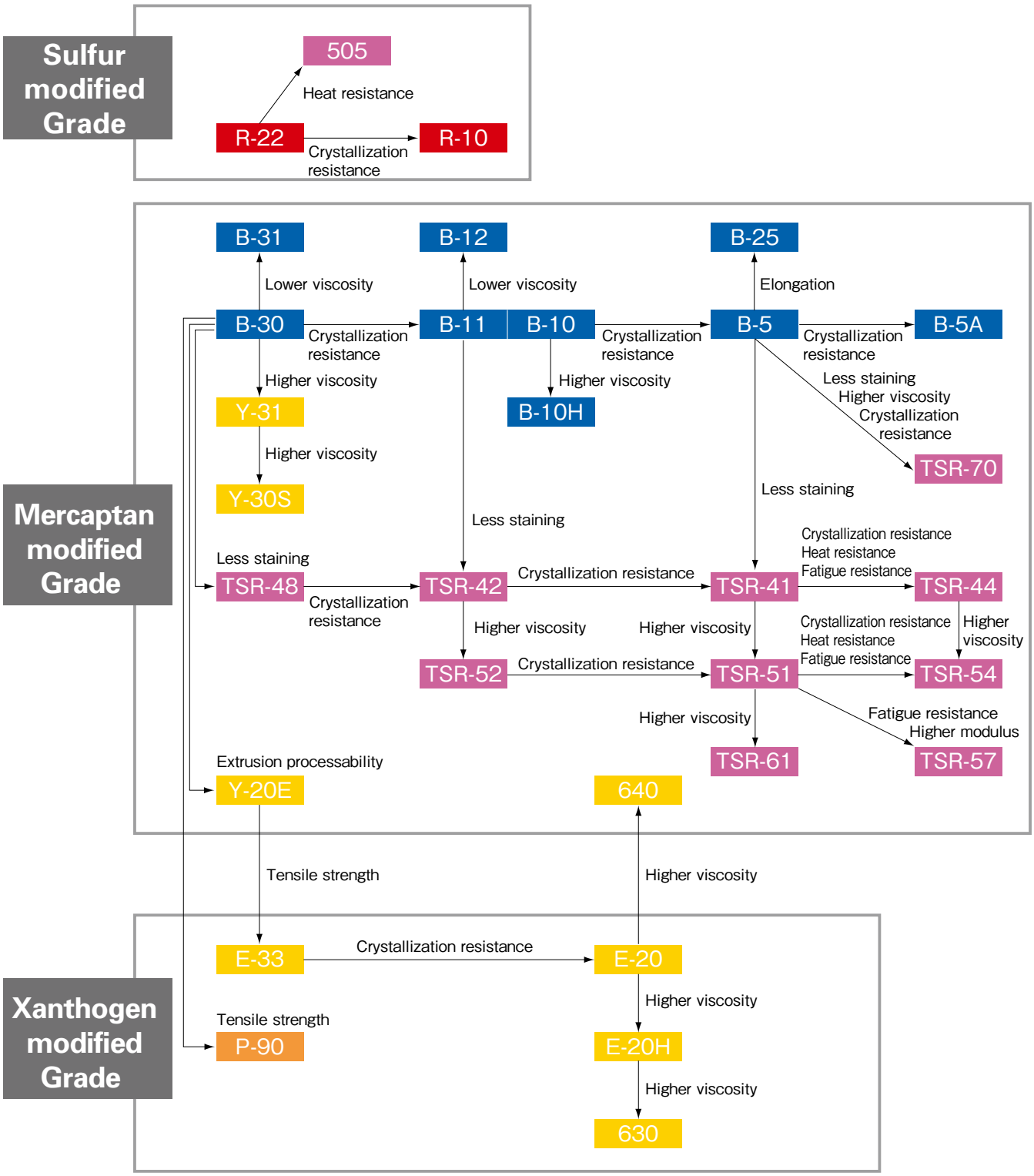


Figure-2 Skyprene Grades and Characteristics

Industrial Applications

Development Chart



[TSR] is a registered trademark of TOSOH Corporation

Industrial Applications

Products and Characteristics

Product	Type	Mooney Viscosity ML (1+4) 100℃	Crystallization resistance	
B-5A	Mercaptan-modified	40 ～ 50	Very High	The slowest crystallization rate. Extremely small change in
B-5		45 ～ 53	High	Slow crystallization rate. Low change in hardness at low
B-10		47 ～ 55		Crystallization rate is intermediate between B-30 and B-5.
B-10H		65 ～ 85		High mooney viscosity form of B-10.
B-11		45 ～ 53		Crystallization rate is intermediate between B-30 and B-5.
B-12		36 ～ 44		Low mooney viscosity form of B-11.
B-25		45 ～ 53		High elongation form of B-5.
B-30		45 ～ 53	Medium	General purpose grade of mercaptan modified type with a
B-31		36 ～ 44		Low viscosity form of B-30.
Y-20E		43 ～ 53		The best extrusion characteristics of all Skyprene grades,
Y-30S		111 ～ 135		High viscosity form of B-30.
Y-31		90 ～ 110		Low viscosity form of Y-30S.
P-90	Xanthogen-modified	40 ～ 50	Relatively Low	Xanthogen modified type with crystallization rate slightly
E-20		43 ～ 53	High	Extrusion grade with slower crystallization rate.
E-20H		54 ～ 74		High viscosity form of E-20.
E-33		43 ～ 53	Medium	Extrusion grade of xanthogen modified type with a medium
630		100 ～ 120	High	High viscosity form of E-20H.
640	Mercaptan-modified	70 ～ 100	Very High	Extrusion grade of mercaptan modified type with excellent
TSR-41		40 ～ 50		Low viscosity form of TSR-51.
TSR-42		40 ～ 50	High	Low viscosity form of TSR-52.
TSR-44		40 ～ 50	Very High	Low viscosity form of TSR-54.
TSR-48		45 ～ 53	Medium	Similar to B-30 in all respects, furthermore with superior
TSR-51		55 ～ 75	Very High	Representative grade of TSR series having slow crystalliz
TSR-52		55 ～ 75	High	Similar to TSR-51 in all respects except crystallization re
TSR-54		60 ～ 80	Very High	The most crystallization resistant grade of TSR series, off
TSR-57		67 ～ 80		High elastic modulus form of TSR-51.
TSR-61		90 ～ 110		High viscosity form of TSR-51.
TSR-70		81 ～ 95		High mooney viscosity form of B-5.
R-10	Sulfur-modified	35 ～ 55 (＊1)	High	Similar to R-22 in all respects except crystallization rate.
R-22		35 ～ 55 (＊1)	Medium	General purpose grade in sulfur modified type with medium
505		34 ～ 54 (＊1)	Relatively High	Heat resistance close to that of the mercaptan modified

Note ＊1: Mooney viscosity at the time of production

Characteristics	Applications
hardness at low temperature.	Automotive rubber parts Industrial rubber goods Electrical wire and cables Belts Hoses Rolls Anti-vibration rubber parts Others
temperature.	
medium rate of crystallization.	
offering smooth finishes on extrusions. Suitable for extruding parts and calender products.	Extruded products Calender products
	Automotive rubber parts Industrial rubber goods Electrical wire and cables Belts, Hoses, Rolls Anti-vibration rubber parts Others
faster than B-30, offering extremely high mechanical strength.	
	Extruded products Calender products Others
rate of crystallization, offering a good balance of mechanical strength and extrusion characteristics.	
crystallization resistance.	
	Automotive rubber parts (Boots etc) Industrial rubber goods Electrical wire and cables Hoses Rolls Others
fluidity and less staining for injection molding.	
ation rate and slightly high Mooney viscosity.	
sistance. Crystallization rate is intermediate between TSR-48 and TSR-51.	
ering the best resistance to heat and dynamic fatigue resistance.	
	Belts Rolls Sponges Linings Industrial rubber goods Others
rate of crystallization.	
grade, offering better dynamic fatigue resistance.	

Industrial Applications

General-Purpose Grades

Skyprene general-purpose grades

B-30, B-31, Y-30S, Y-31, P-90

Skyprene general-purpose grades' modulus, tensile strength, and tear strength are increased through the use of raw rubber with a high mooney viscosity. Their properties are shown in table 1.

SKYPRENE B-30

Skyprene B-30 is a mercaptan-modified, general-purpose grade with a medium rate of crystallization and moderate mooney viscosity. It offers good heat, oil, and weather resistance and good storage stability.

SKYPRENE B-31

Skyprene B-31 is the low-viscosity form of B-30. It features good fluidity and dimensional stability because of its low mooney viscosity. This is why B-31 is suitable for extruding, calendering, and injection molding. It also features low calorification during mill mixing, which positively affects the stability of mooney scorch and overcomes most other problems during mixing.

SKYPRENE Y-30S

Skyprene Y-30S is similar to B-30 in all respects except mooney viscosity, which is considerably higher. The high mooney viscosity helps to reduce production costs because it makes it possible to use a large amount of filler or oil. To improve product processability, it is possible to blend Y-30S with other grades. Y-30S is also used for adhesives.

SKYPRENE Y-31

Skyprene Y-31 is the low-viscosity form of Y-30S. Its processability and fluidity are better than that of Y-30S.

SKYPRENE P-90

Skyprene P-90 is a xanthogen-modified grade with high mechanical strength and modulus. Its crystallization rate is slightly faster than B-30's.

<Table 1> GENERAL PROPERTIES

SKYPRENE PRODUCTS		B-30	B-31	Y-30S	Y-31	P-90
Formulation	(phr)					
SKYPRENE				100		
MgO				4		
Stearic acid				0.5		
SRF Carbon Black (N-770)				30		
ZnO				5		
Accelerator ETU				0.5		
Total				140.0		
Raw Rubber Mooney Viscosity						
ML(1+4)100℃		49	42	127	100	45
Compound Properties						
Mooney Scorch ML(1)125℃						
Vm		52	46	85	74	47
t5	min	7.9	8.1	6.1	6.5	7.5
Vulcanizate Properties						
(Cure; 20min, at 160℃)						
Original						
H_S (Durometer-A)		66	65	68	69	67
T_B	MPa	23.1	23.0	23.8	23.4	26.0
E_B	%	390	400	380	380	420
M_{300}	MPa	16.3	15.9	17.7	17.4	17.5
Aging Test						
(70hrs at 100℃)						
A_H	pts	4	4	3	3	4
$A_C(T_B)$	%	-16	-16	-18	-16	-21
$A_C(E_B)$	%	-15	-13	-24	-21	-24
Compression Set						
(70hrs at 100℃)						
CS	%	36	37	34	36	36
Low Temperature Properties						
Gehman Torsion Test						
T_2	℃	-31.7	-30.9	-32.0	-31.6	-31.5
T_5	℃	-35.5	-35.3	-35.4	-35.3	-35.4
T_{10}	℃	-36.4	-36.3	-36.3	-36.2	-36.3
T_{100}	℃	-41.2	-40.8	-41.0	-40.9	-41.3
Tg	℃	-38.0	-37.7	-37.5	-37.8	-37.7
Permanent Set						
(-10℃, 200%Elongation)						
PS	%	123	130	114	116	136

*These figures are only for reference purposes and therefore do not serve as specifications.

Applications

Automotive rubber parts, industrial rubber goods, electrical wire and cables, hoses, belts and rolls, anti-vibration rubber, and others

Industrial Applications

Crystallization-Resistant Grades

Skyprene Crystallization-Resistant Grades

B-5, B-5A, B-10, B-10H, B-11, B-12, B-25

The general-purpose grades gradually crystallize at low temperatures.

To improve crystallization resistance, the polymer molecular structure is made more irregular than that of general-purpose grades. This slows down the crystallization rate. Compared to general grades, the crystallization-resistant grades generally have lower vulcanizate properties.

SKYPRENE B-5

Skyprene B-5 has superb crystallization-resistant properties. This compound is as easy to process as noncrystalline rubber, even in cold weather.

SKYPRENE B-5A

Skyprene B-5A is the most crystallization-resistant grade in the Skyprene lineup.

SKYPRENE B-10

Skyprene B-10 offers a crystallization rate between that of Skyprene general-purpose grade B-30 and Skyprene crystallization-resistant grade B-5.

SKYPRENE B-10H

Skyprene B-10H is the high viscosity grade of B-10.

SKYPRENE B-11

Skyprene B-11's crystallization rate is almost equal to B-10's.

SKYPRENE B-12

Skyprene B-12 possesses the same rate of crystallization as B-11 and has a low mooney viscosity.

SKYPRENE B-25

B-25 improves upon the elongation of B-5, however the resistance to crystallization is a bit less than B-5.

<Table 2> GENERAL PROPERTIES

SKYPRENE PRODUCT		B-5	B-5A	B-10	B-10H	B-11	B-12	B-25
Formulation (phr)								
SKYPRENE					100			
MgO					4			
Stearic acid					0.5			
SRF Carbon Black (N-770)					30			
ZnO					5			
Accelerator ETU					0.5			
Total					140.0			
Raw Rubber Mooney Viscosity ML(1+4)100℃		47	43	52	70	46	39	48
Compound Properties: Mooney Scorch ML(1)125℃								
Vm		52	47	54	65	52	45	51
t5	min	8.9	10.0	8.2	7.6	8.4	8.8	9.3
Vulcanizate Properties (Cure;20min,at 160℃)								
Original								
H_S(Durometer-A)		65	65	66	66	66	65	65
T_B	MPa	21.5	21.1	21.1	21.4	21.1	21.6	22.8
E_B	%	390	390	380	370	380	390	410
M_{300}	MPa	15.2	14.7	14.9	15.7	15.4	15.0	15.2
Aging Test (70hrs at 100℃)								
A_H	pts	4	6	5	5	6	5	4
$A_C(T_B)$	%	-16	-13	-23	-24	-20	-16	-15
$A_C(E_B)$	%	-13	-15	-21	-22	-21	-16	-16
Compression Set (70hrs at 100℃)								
CS	%	35	39	35	35	38	38	37
Low Temperature Properties Gehman Torsion Test								
T_2	℃	-30.2	-28.9	-30.2	-30.3	-30.3	-30.3	-30.1
T_5	℃	-32.9	-31.7	-33.6	-34.0	-34.5	-34.9	-32.6
T_{10}	℃	-35.0	-34.7	-35.2	-35.3	-35.1	-35.3	-35.1
T_{100}	℃	-38.5	-37.2	-38.9	-39.5	-39.8	-40.3	-38.4
Tg	℃	-35.9	-34.7	-36.4	-36.2	-36.4	-36.9	-35.9
Permanent Set (−10℃, 200%Elongation)								
PS	%	18	7	31	31	33	47	25

*These figures are only for reference purposes and therefore do not serve as specifications.

Applications

Automotive rubber parts, industrial rubber goods, electrical wire and cables, hoses, belts and rolls, anti-vibration rubber, and others

Industrial Applications

Injection Molding Grades

Skyprene injection-molding grades

TSR-41, TSR-42, TSR-44, TSR-51, TSR-52
TSR-54, TSR-57, TSR-61, TSR-70, TSR-48

Each Skyprene injection-molding grade features these characteristics:

1. Heightened resistance to mold staining, reducing the frequency of washing.
2. Smooth separation of parts from the molds, reducing defects.
3. Excellent flow in the injection machines and molds, avoids decreasing mechanical strength at the welded locations of compounds.
4. Superior stability in storage, minimizing such problems as scorch and the like.
5. Excellent cold resistance and less change in hardness at low temperature. The brittle point may be improved with combinations of specific plasticizers.
6. High heat resistance and mechanical strength, making these compounds ideal for applications requiring high reliability, such as car safety devices and gears.

SKYPRENE TSR-51

Skyprene TSR-51 is a representative grade from our lineup for injection molding. This grade displays a slow crystallization rate and a slightly high Mooney viscosity.

SKYPRENE TSR-41

Skyprene TSR-41 is low viscosity form of TSR-51.

SKYPRENE TSR-61

Skyprene TSR-61 is high viscosity form of TSR-51.

SKYPRENE TSR-52

Skyprene TSR-52 is similar to TSR-51 in all respects except crystallization resistance. Crystallization rate of TSR-52 is intermediate between TSR-48 and TSR-51.

SKYPRENE TSR-42

Skyprene TSR-42 is low viscosity form of TSR-52.

SKYPRENE TSR-54

Skyprene TSR-54 is the most crystallization resistant grade of the TSR series and offers the best resistance to heat and dynamic fatigue.

SKYPRENE TSR-44

Skyprene TSR-44 is low viscosity form of TSR-54.

SKYPRENE TSR-57

Skyprene TSR-57 is a well-balanced grade in modulus and resistance to fatigue. TSR-57 also has excellent strength.

SKYPRENE TSR-70

Skyprene TSR-70 is similar to B-5 in crystallization resistance, and high viscosity.

SKYPRENE TSR-48

Skyprene TSR-48 is similar to B-30 in all respects, furthermore it possesses superior fluidity and less staining properties.

Applications

Automotive rubber parts (boots etc.),
industrial rubber parts, electrical wire and cables,
hoses and rolls, and others

<Table 3> GENERAL PROPERTIES

SKYPRENE PRODUCT		TSR-41	TSR-42	TSR-44	TSR-51	TSR-52	TSR-54	TSR-57	TSR-61	TSR-70	TSR-48
Formulation	(phr)										
SKYPRENE						100					
MgO						4					
Stearic acid						0.5					
SRF Carbon Black (N-770)						30					
ZnO						5					
Accelerator ETU						0.5					
Total						140.0					
Raw Rubber Mooney Viscosity ML(1+4)100℃		44	44	48	66	64	71	74	97	88	47
Compound Properties Mooney Scorch ML(1)125℃											
Vm		50	51	54	64	62	64	68	79	74	50
t5	min	9.7	9.3	10.6	8.6	8.3	9.3	8.2	7.6	7.7	8.3
Vulcanizate Properties (Cure; 20min, at 160℃) Original											
H_S(Durometer-A)		66	66	65	66	66	66	66	67	66	66
T_B	MPa	21.3	21.5	20.4	21.5	22.1	22.9	22.0	22.1	20.8	23.2
E_B	%	390	390	400	370	380	410	380	360	350	400
M_{300}	MPa	14.8	14.7	14.3	15.8	16.0	15.1	15.9	16.5	20.8	16.2
Aging Test (70hrs at 100℃)											
A_H	pts	3	4	4	3	3	3	2	3	5	6
$A_C(T_B)$	%	-11	-15	-8	-16	-18	-8	-9	-10	-14	-15
$A_C(E_B)$	%	-13	-18	-10	-16	-16	-10	-13	-14	-14	-18
Compression Set (70hrs at 100℃)											
CS	%	45	42	43	41	43	45	39	39	37	45
Low Temperature Properties Gehman Torsion Test											
T_2	℃	-30.0	-30.7	-26.7	-29.9	-30.4	-27.4	-30.2	-30.0	-30.3	-33.1
T_5	℃	-32.3	-35.0	-30.4	-32.1	-34.7	-30.6	-32.7	-31.8	-34.2	-35.6
T_{10}	℃	-34.9	-35.3	-31.4	-35.0	-35.2	-31.8	-35.2	-34.7	-35.3	-36.9
T_{100}	℃	-37.8	-40.2	-36.2	-37.7	-40.1	-36.2	-38.4	-37.8	-39.9	-41.1
Tg	℃	-35.5	-36.8	-33.0	-35.4	-36.5	-33.1	-35.4	-34.3	-36.4	-38.4
Permanent Set (-10℃, 200%Elongation)											
PS	%	11	45	6	13	41	6	11	13	9	125

* These figures are only for reference purposes and therefore do not serve as specifications.

Industrial Applications

Extrusion Grades

Skyprene Extrusion Grades

Y-20E, E-33, E-20, E-20H, 630, 640

The characteristics of their standard formulations are indicated in table 4.

SKYPRENE Y-20E

Skyprene Y-20E offers the best extrusion characteristics among the extrusion grades, but its mechanical characteristics are inferior to E-33. It is generally blended with Skyprene crystallization-resistant grade B-10 or with Skyprene general-purpose grade B-30.

SKYPRENE E-33

Skyprene E-33 is the xanthogen-modified grade for extruding. The mechanical properties are the same as B-30's. In addition, E-33 has an excellent processability and extrudability. E-33 is suitable for extruding and calendering.

SKYPRENE E-20

Skyprene E-20 is similar to E-33 in all respects except its better crystallization resistance.

SKYPRENE E-20H

Skyprene E-20H is the high-viscosity form of E-20. It offers less shape deformation at the time of vulcanization.

SKYPRENE 630

Skyprene 630 is the high-viscosity form of E-20H.

SKYPRENE 640

Skyprene 640 is a mercaptan-modified extrusion grade with excellent crystallization resistance. Its mooney viscosity is between that of E-20H and 630.

<Table 4>
GENERAL PROPERTIES

SKYPRENE PRODUCT		Y-20E	E-33	E-20	E-20H	630	640
Formulation (phr)							
SKYPRENE		100					
MgO		4					
Stearic acid		0.5					
SRF Carbon Black (N-770)		30					
ZnO		5					
Accelerator ETU		0.5					
Total		140.0					
Raw Rubber Mooney Viscosity							
ML(1+4)100℃		49	48	47	62	110	81
Compound Properties							
Mooney Scorch							
ML(1)125℃							
Vm		62	57	60	71	95	85
t5	min	7.0	6.8	7.4	6.3	5.8	7.1
Vulcanizate Properties							
(Cure;20min,at 160℃)							
Original							
H_S(Durometer-A)		66	68	67	68	68	69
T_B	MPa	19.8	22.6	21.4	21.7	21.4	20.8
E_B	%	360	360	340	340	340	330
M_{100}	MPa	3.1	3.4	3.3	3.5	3.4	3.4
Aging Test							
(70hrs at 100℃)							
A_H	pts	4	6	5	5	7	6
$A_C(T_B)$	%	-18	-18	-14	-17	-13	-14
$A_C(E_B)$	%	-17	-17	-15	-18	-21	-21
Compression Set							
(70hrs at 100℃)							
CS	%	39	33	36	35	36	40
Low Temperature Properties							
Gehman Torsion Test							
T_2	℃	-30.1	-31.7	-30.2	-29.8	-30.0	-29.9
T_5	℃	-35.1	-35.3	-33.1	-31.8	-31.8	-32.2
T_{10}	℃	-35.8	-36.0	-35.1	-34.8	-34.8	-35.0
T_{100}	℃	-40.8	-41.1	-38.9	-37.8	-38.2	-38.1
Tg	℃	-37.5	-37.4	-35.7	-34.1	-34.4	-34.6
Permanent Set							
(-10℃, 200%Elongation)							
PS	%	100	110	15	10	10	11

*These figures are only for reference purposes and therefore do not serve as specifications.

Applications

Hoses, belts and rolls, electrical wire and cables, sponges, window profiles, automotive rubber parts, industrial rubber goods, rubber coated fabrics, and others

Industrial Applications

Sulfur-modified Grades

Skyprene Sulfur-modified Grades

R-22, R-10, 505

Skyprene sulfur-modified grades have sulfur links (-Sx-,x:2 to 6) in their molecular chains. Their characteristics, therefore, differ from those of mercaptan-modified Skyprene grades in the following respects.

1. The molecular chains are degraded by mechanical shearing forces, which, in turn, reduces the mooney viscosity.
2. The mooney viscosity drops during the initial storage period and then rises gradually.
3. Compared with mercaptan-modified grades, the sulfur-modified grades offer superior mechanical strength, including tensile and tear strength. Their heat resistance, however, is inferior to that of the mercaptan grades.
4. The sulfur-modified grades adhere more easily to textiles and metals.
5. Vulcanization is possible through the addition of metal oxide, mainly zinc oxide, without the need of a vulcanization accelerator.

SKYPRENE R-22

Skyprene R-22 is a sulfur-modified general-purpose grade having a medium rate of crystallization.

SKYPRENE R-10

Skyprene R-10 and R-22 are similar in all respects except the better crystallization resistance of R-10. It is easier to process R-10 in cold weather than R-22.

SKYPRENE 505

Skyprene 505 has heat resistance close to that of the mercaptan-modified grades and features better dynamic fatigue resistance.

Applications

Belts, rubber linings, wet suits, sponges, industrial rubber goods

<Table 5> GENERAL PROPERTIES

SKYPRENE PRODUCT		R-22	R-10	505
Formulation	(phr)			
SKYPRENE		100		
MgO		4		
Stearic acid		0.5		
SRF Carbon Black (N-770)		30		
ZnO		5		
Total		139.5		
Raw Rubber Mooney Viscosity ML(1+4)100℃		42	40	42
Compound Properties				
Mooney Scorch ML(1)125℃				
Vm		47	32	42
t5	min	29.5	27.6	19.2
Vulcanizate Properties (Cure;20min, at 160℃)				
Original				
H_S(Durometer-A)		71	71	71
T_B	MPa	23.5	22.8	23.8
E_B	%	490	490	510
M_{300}	MPa	14.2	13.7	13.7
Aging Test (70hrs at 100℃)				
A_H	pts	3	3	4
$A_C(T_B)$	%	-14	-15	-13
$A_C(E_B)$	%	-21	-27	-16
Compression Set				
CS (100℃×22hrs)	%	47	43	34
CS (100℃×70hrs)	%	63	61	49
Low Temperature Properties				
Gehman Torsion Test				
T_2	℃	-30.9	-30.4	-31.5
T_5	℃	-35.0	-33.8	-35.2
T_{10}	℃	-35.5	-35.1	-35.9
T_{100}	℃	-40.7	-39.5	-40.7
Tg	℃	-36.9	-35.9	-37.3
Permanent Set (-10℃, 200%Elongation)				
PS	%	88	31	84

*These figures are only for reference purposes and therefore do not served as specifications.

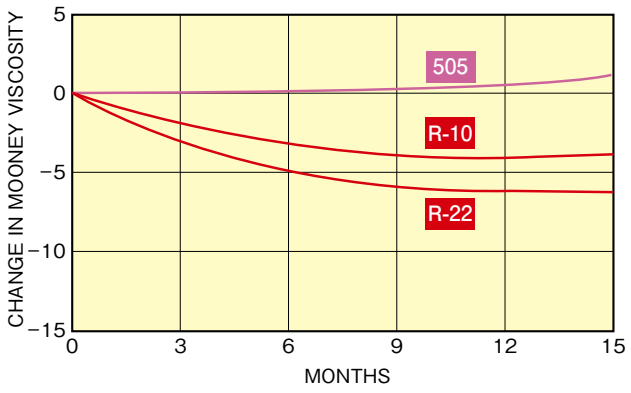
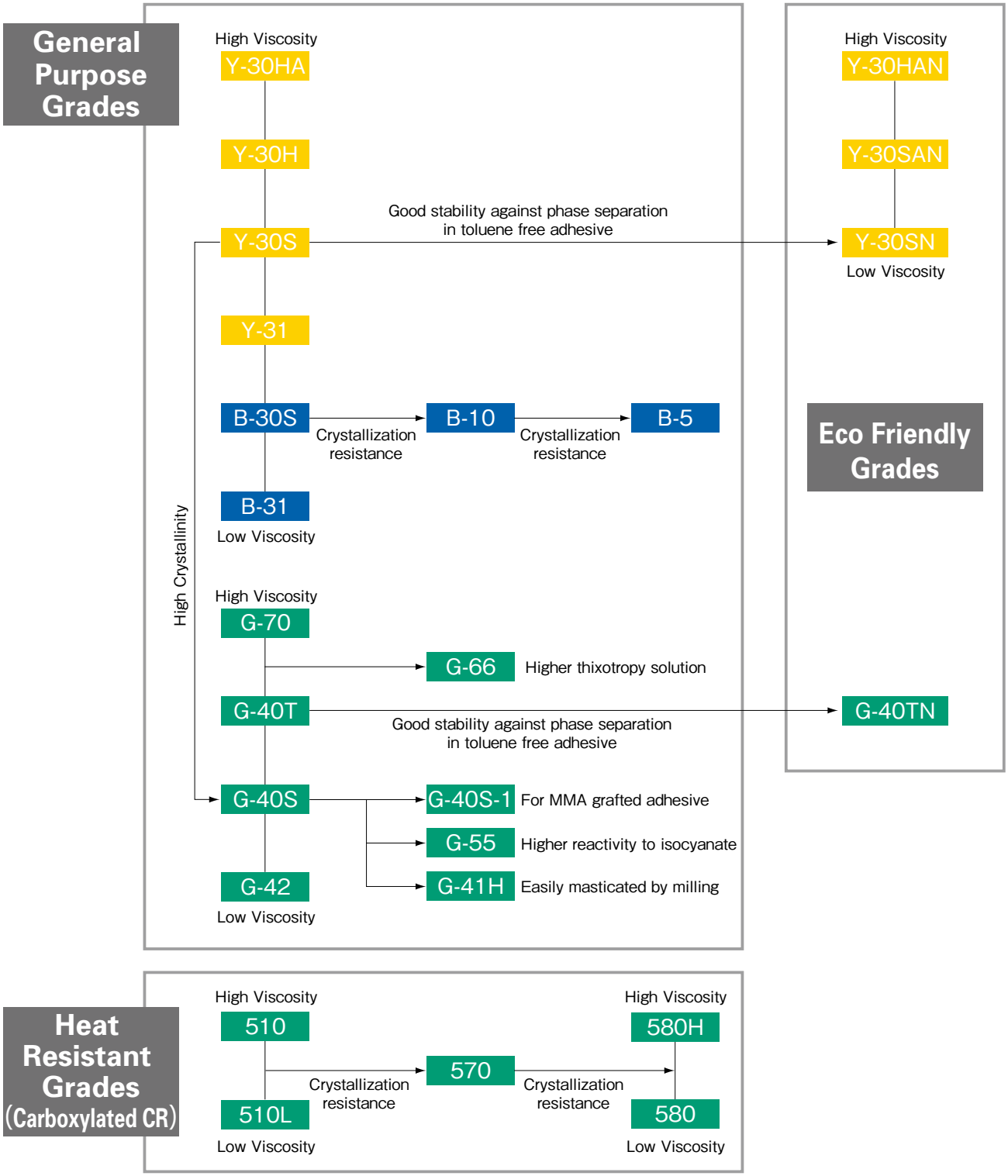


Figure-3 Stock stability of R-10, R-22 and 505, change in mooney viscosity at room temperature

Adhesive Applications

Development Chart



Adhesive Applications

Products and Characteristics

Product	Mooney viscosity	10% Solution Viscosity*3	Crystallization Rate	Chip Size	Characteristics
General-Purpose					
G-40S	81～95*1	300～600	Fast	Small	Typical grade of fast crystallization rate and excellent initial bonding strength.
G-40S-1	81～99*1	300～700			Ideal for use in MMA grafted adhesive for soft PVC and synthetic leather.
G-40T	96～113*1	600～900			Higher viscosity form of G-40S with superior heat resistance.
G-70	—	1600～2400			
G-41H	75～90*1	250～500			Thiuram stabilized type. Easily masticated, excellent initial bonding strength.
G-42	36～48*1	70～130			Lower viscosity form of G-40S. Ideal for use in sprays.
G-55	80～96*1	300～600			Higher reactivity to isocyanate than G-40S.
G-66	—	900～1500			Fluidity of the solution is low and higher thixotropy than other grades.
Y-30S	111～135*2	600～1100	Medium		Typical grade. Medium crystallization rate, higher heat resistance and tack retention time.
Y-30H	—	1400～2100			Higher viscosity form of Y-30S with superior heat resistance.
Y-30HA	—	1900～2600			
Y-31	90～110*2	340～660			Lower viscosity form of Y-30S.
B-30S	45～53*2	110～170			Lower viscosity form of Y-31.
B-31	36～44*2	—		Large	
B-5	45～53*2	—	Slow		Crystallization resistant form of B-30S. Effective for the improvement of tack retention time.
B-10	47～55*2	—			
Heat resistant					
510	48～60*1	120～260	Fast	Small	Excellent heat resistance and initial bonding strength.
510L	35～47*1	80～170			
570	42～64*1	—	Medium		Typical grade. Medium crystallization rate, excellent heat resistance.
580	35～47*1	60～130	Slow		Slower crystallization and lower carboxyl content form of 570. Effective for the improvement of tack retention time.
580H	57～77*1	100～300			
Eco Friendly					
G-40TN	96～113*1	600～900	Fast	Small	Eco friendly grades of G-40T.
Y-30SN	—	600～1100	Medium		Eco friendly grades of Y-30S.
Y-30SAN	—	1100～1700			Eco friendly grades. Higher viscosity of Y-30SN.
Y-30HAN	—	1900～2900			Eco friendly grades of Y-30HA. Highest viscosity of Y Type.

＊1：ML (1+2.5) 100℃　　＊2：ML (1+4) 100℃
＊3：10% Toluene solution viscosity (mPa.s / Brookfield (BL) type viscometer, 23℃)

Adhesive Applications

General-Purpose Grades

Skyprene General-Purpose Grades

B-30S, B-31, Y-31, Y-30S, Y-30H, Y-30HA, B-5, B-10, G-40S, G-42, G-40T, G-70, G-40S-1, G-41H, G-55, G-66

CR-based adhesives are used in wide-ranging applications. They feature excellent adhesion, flame resistance, chemical resistance, oil resistance, and bonding strength. Skyprene general-purpose grades for adhesive applications are classified by crystallization rate and range of mooney viscosity.

B-30S, B-31, Y-31, Y-30S, Y-30H, Y-30HA

These grades have moderate crystallization rates. The B types are low molecular weight and the Y types are high molecular weight. Both can be used as blends to adjust adhesive viscosity.

B-5, B-10

These are crystallization-resistant grades. They are effective in improving tack retention time.

G-40S, G-42, G-40T, G-70

These grades have a high crystallization rate. The low molecular weight types, represented by G-42, are used for spray adhesives. The high molecular weight types, G-70 show higher heat resistance than their low molecular weight counterparts and can reduce costs by lowering the CR content of adhesives.

G-40S-1

The ideal use for this grade is as MMA-grafted adhesive for soft PVC or synthetic leather. The coloration of this solution is better than that of other grades.

G-41H

This grade shows easy mastication and the stability of adhesive viscosity, and the phase separation stability are better than other grades.

G-55

This grade shows higher reactivity to isocyanates.

G-66

This grade shows specific solution properties, such as a low fluidity in solution and higher thixotropy.

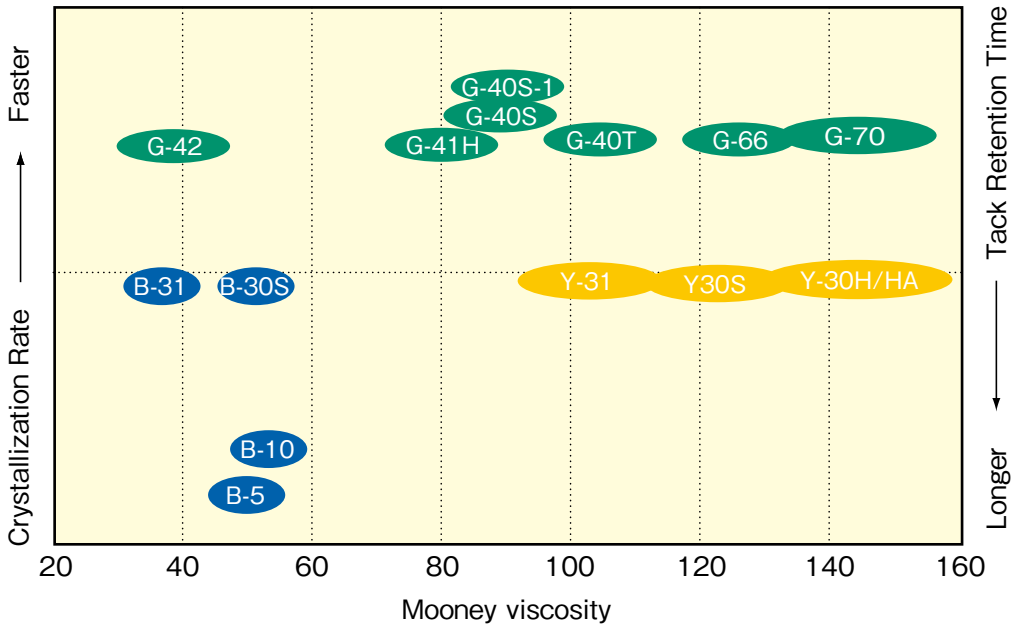


Figure-4 Characteristics and Relationship of General-Purpose Grades

Adhesive Applications

Heat Resistant Grades (Carboxylated)

Skyprene Heat Resistant Grades

570, 510, 510L, 580, 580H

Heat resistant carboxylated grades can be readily cured with metal oxide. Due to the rapid formation of ionic crosslinks, these grades exhibit superior heat resistance at temperatures over 80℃.

570

Skyprene 570 is a representative grade of Heat resistant Grades having a medium crystallization rate.

510, 510L

Skyprene 510 and 510L are fast crystallization rate form of Heat resistant grades.

580, 580H

Skyprene 580 and 580H are slow crystallization rate form of Heat resistant grades.

<Table 6> Bonding Properties of Heat Resistant Grades

SKYPRENE PRODUCT	570	510	Y-30S	G-40T
Formulation (phr) Rubber compound (milling) CR MgO ZnO			100 4 2	
Pre-reaction (23℃ for 16hrs) Alkylphenolic resin MgO Toluene Water			40 4 80 0.4	
Solvents Toluene Normal Hexane Ethyl acetate iso Propanol	 134 128 86 10	 134 128 86 10	 116 117 78 —	 126 123 82 —
Solid content (%)	25.5	25.5	26.9	25.7
Solution viscosity (mPa·s/25℃)	2700	2900	3100	3100
Peel strength Bonding strength (at 23℃) after 1hr N/25mm after 7days N/25mm Bonding strength at high temp. after 5min. (at 80℃) N/25mm after 7days (at 80℃) N/25mm after 7days (at 100℃) N/25mm	 101 157 76 98 86	 109 145 70 97 76	 73 123 9 62 21	 79 123 9 55 25

*These figures are only for reference purposes and therefore do not serve as specifications.

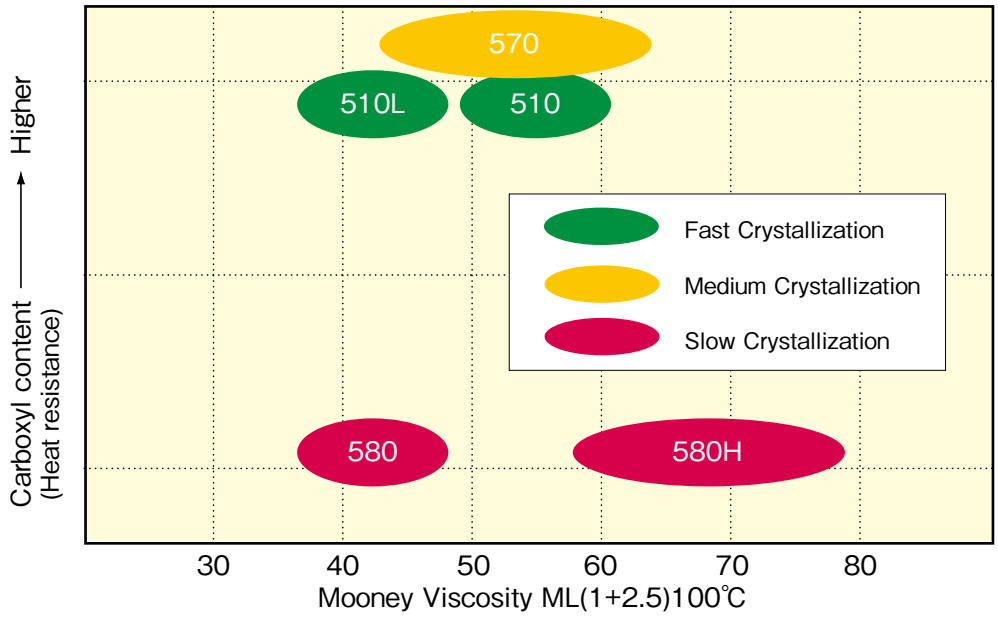


Figure-5 Characteristics and Relationship of Heat resistant Grades

Adhesive Applications

Eco Friendly Grades

Skyprene Eco Friendly Grades

Y-30SN, Y-30SAN, Y-30HAN, G-40TN

Polychloroprene rubber is widely used for dry contact adhesives because of good adhesion, flame resistance, chemical resistance and high bonding strength. These adhesives are made by dissolving CR in organic solvent (toluene, MEK, etc).

To reduce the effect on environment and human health, the harmful solvent (Benzene, Toluene, Xylene (BTX)) should be decreased in the adhesives.

However changing composition of solvent might cause the problem of phase separation on adhesives in storage period.

TOSOH developed Eco Friendly Grades, which improve stability against phase separation for Eco Friendly Adhesive like a toluene-free formulation.

<Table 7> Bonding Properties of Y-30S and Y-30SN

	Typical formulation with Toluene		Eco Friendly formulation	
SKYPRENE PRODUCT	Y-30S	Y-30SN	Y-30S	Y-30SN
Formulation (phr)				
Rubber compound (milling)				
CR	100		100	
MgO	4		4	
ZnO	2		2	
Pre-reaction (23℃ for 16hrs)				
Alkylphenolic resin	40		40	
MgO	4		4	
Water	0.4		0.4	
Toluene	80		—	
Normal Hexane	—		80	
Solvents				
Toluene	135		—	
Cyclo Hexane	—		80	
Normal Hexane	129		80	
Ethyl acetate	86		80	
Acetone	—		80	
Solid content (%)	25.8		27.3	
Solution viscosity (mPa·s/25℃)	2680	2510	2410	2360
Stability at 23℃				
original	no separation	no separation	no separation	no separation
after 1 week	no separation	no separation	Phase separation	no separation
after 1 month	no separation	no separation	Phase separation	no separation
after 3 months	Phase separation	no separation	Phase separation	no separation
Peel strength (Original)				
Bonding strength at 23℃				
after 1hr (N/25mm)	73	77	103	99
after 7days (N/25mm)	163	171	172	171
Bonding strength at 80℃				
after 7days (N/25mm)	56	53	61	62

*These figures are only for reference purposes and therefore do not serve as specifications.

Line up of Eco Friendly Grades

Product	Crystallization Rate	10% Toluene solution Viscosity (mPa·s)
Y-30SN	Medium	600～1100
Y-30SAN	Medium	1100～1700
Y-30HAN	Medium	1900～2900
G-40TN	Fast	600～900

Storage-stability of Y-30S and Y-30SN

Storage temp. 23℃

	Typical formulation with Toluene		Eco Friendly Formulation	
	Y-30S	Y-30SN	Y-30S	Y-30SN
Original				
After 1 week				
After 1 month				
After 3 months				

LATEX Grades

Products and Characteristics

Latex Grades

LA-502, LA-410, LA-710, LA-660, GFL-280, GFL-820
GFL-890, SL-360, SL-390, SL-590, LH-430

Volatilization of organic solvents in the atmosphere can cause fires and have an adverse effect on the environment and human health. Therefore the necessity for more solvent-free products is growing. Tosoh has developed Skyprene Latex as one type of chloroprene rubber to replace solvent-based materials used for industrial and adhesive applications.

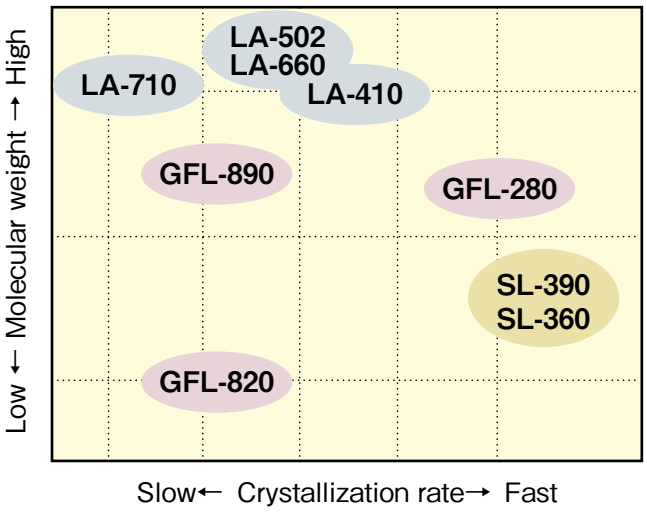


Figure-6 Characteristics and Relationship of Latex Grades

Industrial Applications

Product	Crystallization rate	Characteristics	Application
LA-502	Medium	Typical grade for industrial application.	Gloves, (dip forming)
LA-410	Relatively Fast	Excellent physical properties and abrasion resistance.	
LA-710	Slow	Excellent crystallization resistance.	

Adhesive Applications

LA-660	Medium	Anionic latex for bonding urethane foams by 2 components adhesive.	Adhesive (wet contact)
GFL-280	Fast	Carboxylated anionic latex. Excellent stability and bonding strength.	Adhesive (dry contact)
GFL-820	Medium		
GFL-890			
SL-360	Fast	Higher stability against acid than SL-390.	Adhesive (wet to dry contact)
SL-390		Typical grade for adhesive.	
SL-590		Special grade for excellent bonding strength in higher temp.	

Special Applications

LH-430	—	Special anionic latex.	Surface treatment

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Latex Grades

Industrial Applications

LA Types

These types have excellent stability and their vulcanization products exhibit superior properties. Products made from LA-410 show excellent physical properties and high abrasion resistance. The vulcanization product made from LA-710 has good crystallization resistance.

General Properties of LA Types

Product	LA-502	LA-410	LA-710
Polymer Type	Chloroprene		
Emulsifier	Rosin salt		
Solid content (%)	51 ～ 55	50 ～ 54	50 ～ 54
pH	12 ～ 14	12 ～ 14	12 ～ 14
Crystallization Rate	Medium	Relatively Fast	Slow
Characteristics	General-Purpose	Strength, Abrasion resistance	Crystallization resistance

Latex Grades

Adhesive Applications

GFL Types

GFL types are designed for dry contact adhesive applications. They have the advantages of gel-free components and higher cross-linkability with ZnO. This is superior to those of traditional carboxylated chloroprene latex. In addition, the GFL types have better mechanical, chemical and electrolytic stability than traditional anionic latex.

SL Types

The SL types have fast crystallization rate, and they also display good bonding strength caused by gel-free components, same as GFL types.
The stability of latex is influenced by pH value, therefore SL types can be used for wet-contact adhesive by adjusting the pH.

LA-660

The stability of LA-660 has been adjusted for two components PU foam adhesives. The LA-660 polymer has a high molecular weight as well as high gel content, while the crystallization rate is medium. This means that the bonding strength and heat resistance are very high, whereas the adhesive layer is soft.

General Properties of Latex Grades for Adhesive Applications

Product	GFL-820	GFL-890	GFL-280	SL-360	SL-390	LA-660
Polymer Type	Chloroprene-Methacrylic acid			Chloroprene		Chloroprene
Emulsifier	Anionic			Rosin salt		Rosin salt
pH	2.1 ～ 6.0			12 ～ 14		12 ～ 14
Gel content	None			None	None	High
Solid content (%)	50 ～ 56			50 ～ 54	50 ～ 54	51 ～ 56
Molecular Weight	Low	High	High	High	High	Very High
Crystallization Rate	Medium	Medium	Fast	Fast	Fast	Medium
Stability						
Mechanical	Good			Good		Good
Storage	Good			Good		Good
Electrolyte	Good			Unstable (under lower pH)		Unstable (under lower pH)

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