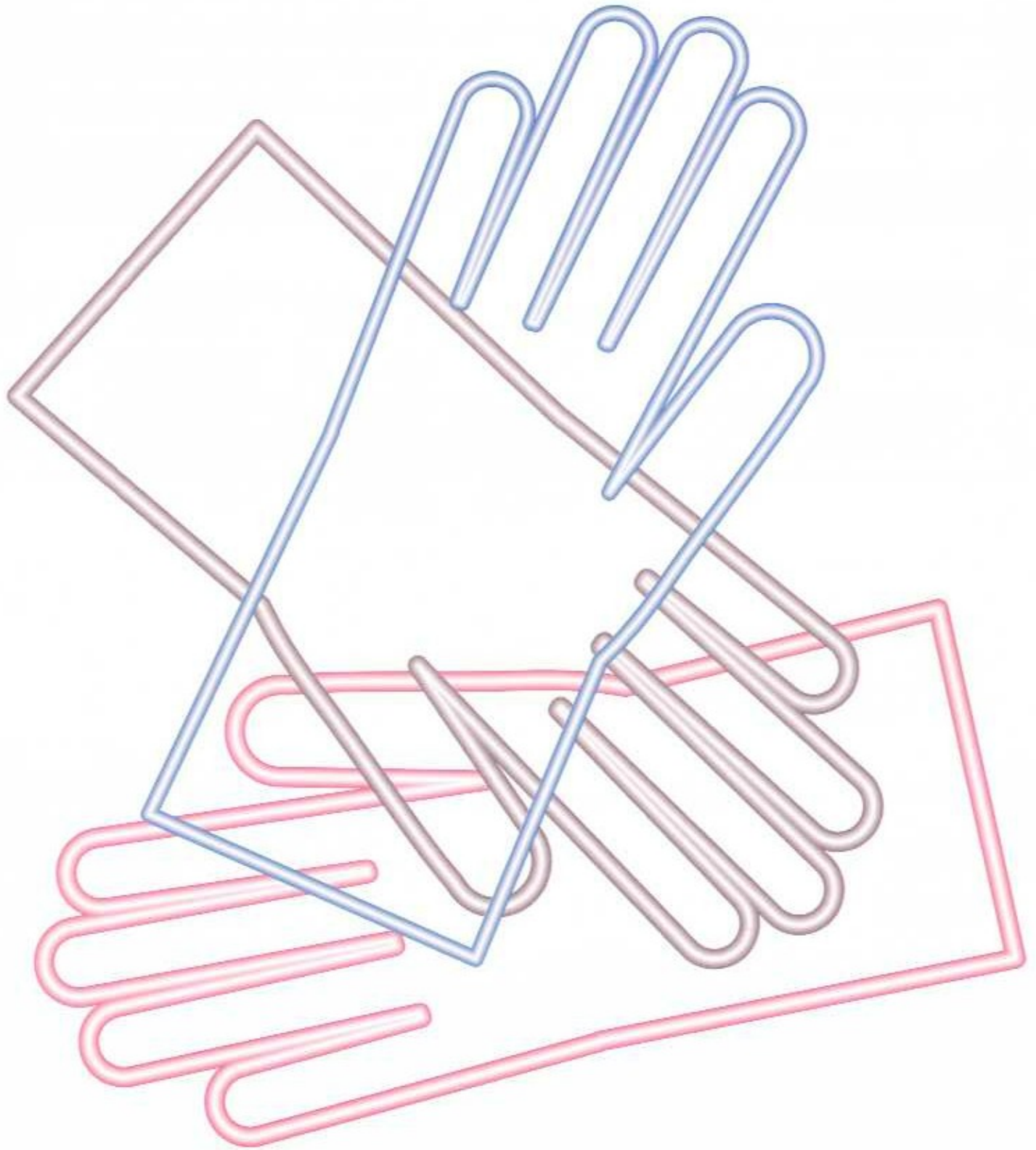


Technical Information on NBR Latex for Gloves

LX550 • LX550L • LX551 • LX552



 **ZEON CORPORATION**

Nipol LX550,LX550L,LX551,LX552 are latexes designed for coagulant dipping operations. There are well suited for the manufacture of gloves that require high stress strain properties,high resistance to abrasion,and good chemical resistance to oils and solvents. These latexes are carboxylated butadiene acrylonitrile copolymer. LX550,LX550L are classified as medium nitrile and LX551,LX552 are classifide as medium-high nitrile.

TYPICAL LATEX PROPRETIES

	LX550	LX550L	LX551	LX552
Total solids (%)	45	45	45	45
pH	8.5	8.0	8.5	8.4
B-Viscosity(mPa·s)	200	50	85	35
Surface Tension (mN/m)	34	33	31	32
Particle size(nm)	110	110	120	110
Gel content (%)	0	0	0	60
Tg (°C)	-27	-27	-14	-12
Bound AN content (%)	27	27	37	37
Free AN content (%)	< 0.015	< 0.015	< 0.015	<0.015
Surface active agent type	Anion	Anion	Anion	Anion

1. LATEX DIPPING

The dipping process consists essentially of dipping of former into latex compound, followed by slow withdraw in such a way as to leave a uniform deposit of latex. After there the process is completed by drying, leaching and vulcanising the deposit. The conventional way to make unsupported gloves is what the application of coagulate dipping principle. Direct coagulant dipping covered is a process whereby covered firstly with a coagulant and secondly dipped into a latex compound including vulcanising agents such as sulfur, zinc oxide.

Single-dip is well suited to make a thin film. Supported gloves will be prepared by direct dipping or by coagulant dipping. The key factor in making the supported gloves is ensuring the adhesion between textile and latex.

2. DIPPING COMPOUND

The glove dipping compound is composed of latex, pH adjuster and curing agent (S/ZnO). The ratio of S/ZnO depends on the glove grade; further TiO₂ is used for Industrial Glove and Household Glove is different from that for Examination Glove and Surgical Glove.

3. COMPOUND RECIPE FOR INDUSTRIAL GLOVE AND HOUSEHOLD GLOVE

	Dry parts
NBR Latex	100
KOH or NH ₄ OH	as required
Sulfur	0.5-0.3
Zinc oxide	0-5.0
ZnBDC	0-0.5
Titanium dioxide	0-5.0
Dispersing agent	0.2-1.0
Stabilizing agent	as required
Defoamer	0.005

Note ZnBDC is Zinc di-n-butyl dithiocarbamate

4. PROCEDURE TO MAKE GLOVES

The typical compound dipping process is described as follows.

Unsupported glove

1. Clean and pre-warm former
2. Dip in coagulant
3. Dry coagulant
4. Compound dip 10-180 seconds
5. Leach for 6 minutes at 35°C
6. Dry at room temperature
7. Dip in binder
8. Apply flock
9. Dry at 80°C for 20 minutes
10. Cure at 120°C for 20 minutes

Supported glove

1. Set the fabric liner to the former
2. Compound dip (low AN content)
3. Dry at room temperature
4. Compound dip (high AN content)
5. Dry at room temperature
6. Unslipped processing
7. Drying
8. Curing

5. TYPICAL PROPERTIES OF COAGULANT DIPPING FILM

The typical properties of coagulant dipping film are indicated in next page.

The following result was obtained from the labo-scale dipped films using the indicated procedure.

It should be noted that the physical properties of dipped film such as tensile strength and modulus are dependent on the type and level of vulcanizing ingredients as well as temperature and length of time of cure.

Films were prepared by coagulant dipping using calcium nitrate as coagulant to dried film thickness of about 0.3mm. Films were dried and cured at 100°C or 120°C.

(1) Cure Dispersion (SZ320D)

	Dry parts	Wet parts
Titanium dioxide	2.0	2.0
Sulfur	0.5	0.5
Zinc oxide	5.0	5.0
ZnBDC	0.25	0.25
Dispersant	0.5	1.11
Ammonium casein	0.2	2.0
Defoamer	0.002	0.005
Water		5.337
	8.452	16.202

Note The mixture has to be ball-milled for 48 hours.

(2) Coagulant Solutions

Calcium nitrate	35
Wetting agent	0.05~1
Water	64

Note The wetting agent is added to improve wetting and to achieve a more uniform distribution of the coagulant on the dipping.

(3) Dipping Compound Formulation

	Dry parts	Wet parts
LATEX(raw latex)	100	222
Cure dispersion		16.9

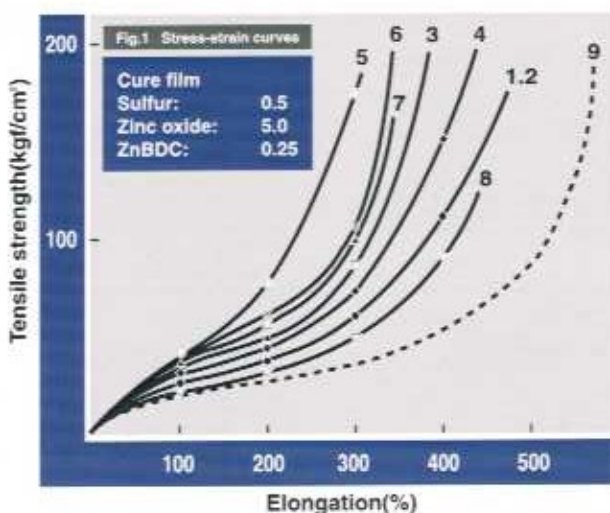
Note Stirring speed should be sufficient to achieve good blending without creating a vortex, entrapping air and causing coagulum.

(4) Typical Compound Properties

	For supported glove	For unsupported glove
Total solids (%)	43	43
pH	8.7	8.7
B-Viscosity (mPa·s)	400<	15
Surface Tension (mN/m)	32	31

Note pH of the final compound should be in the range from 8.5 to 9.0 (pH 9 is better, KHO or NH₄OH adjustment). For supported glove dipping, compound viscosity should be prepared above 400 mPa·s to prevent the penetration into the liner.

A. Property of cure film



No.	Name of Latex	Bound AN content	Gel content
1.	Nipol LX550	27%	Low
2.	Nipol LX550L	27%	Low
3.	Nipol LX551	37%	Low
4.	Nipol LX552	37%	Middle
5.	Latex A	36%	Middle
6.	Latex B	37%	Middle
7.	Latex C	38%	Middle
8.	Latex D	53%	Middle
9.	NR Latex	0%	

Note Latex A, B, C and D are Latex products of another companies

Nipol LX550, LX550L, LX551, LX552 have the properties that the cure films indicate lower initial modulus and higher tensile strength as compared with latexes of other companies.

B.LX550 vulcanizing properties

Curing Accelerator : BZ (ZnBDC)

(1) Compound recipe

NBR Latex	100 parts
KOH or NH ₄ OH	as required(pH9)
(Curing ingredients)	
Sulfur	0.5~0.3parts
Zinc oxide	0~5.0
Titanium Dioxide	2.0
ZnBDC	0.25
Dispersing agent	0.5
Stabilizing agent	0.2

(2) Film producing condition

Film is prepared by coagulant dipping method.
(Coagulant solutions)

Calcium nitrate	30-50 parts
Ethyl alcohol or water	49.95
Wetting agent	0.05

(3) Curing condition

100°C × 40 min.

(4) Tensile strength test conditions

Film is cutting with dumb-bell test piece No.2

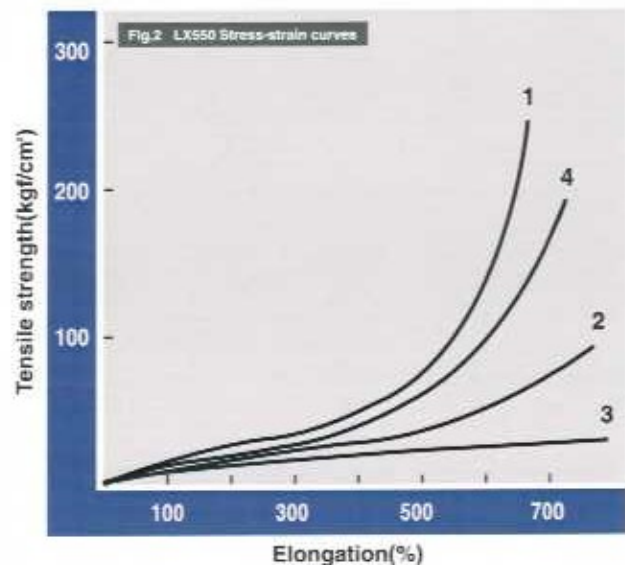
Numbers or sample : 4

Separation speed : 200 mm/min.

LX550 Vulcanization system film properties

	(1)	(2)	(3)	(4)
Md 100%	16.1	8.8	6.3	11.2
Md 200%	27.5	17.1	12.2	19.2
Md 300%	36.3	22.0	16.5	27.5
Md 400%	52.0	26.5	19.5	39.2
Md 500%	79.4	37.3	21.6	64.7
Md 600%	158.8	54.9	23.9	105.9
Md 700%		74.5	25.5	
Tb (Kgf/cm ²)	237.3	89.2		182.4
EL (%)	640	750	1000<	700

Note (1) S=0.5,ZnO=5.0,BZ=0.25,(2) S=3.0,ZnO=1.0,BZ=0.25,
(3) S=3.0,ZnO=0, BZ=0.25,(4) S=2.0,ZnO=2.0,BZ=0.25



C. LX551 vulcanizing properties

Curing condition is 100°C × 40 min, and 120°C × 30 min.
Other conditions are the same as those of LX550.

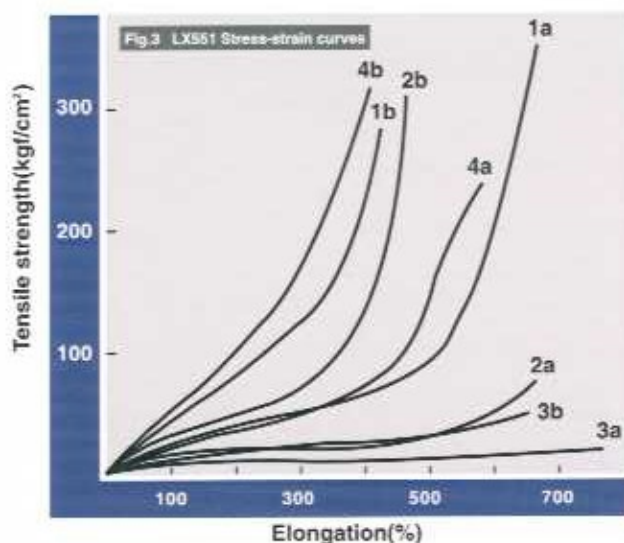
LX551 Vulcanization system and film properties

	(1a)	(2a)	(3a)	(4a)
Md 100%	20.0	13.3	6.7	22.2
Md 200%	33.3	16.4	8.9	34.4
Md 300%	46.7	18.2	8.9	50.4
Md 400%	68.9	22.2	9.1	67.8
Md 500%	102.2	28.9	10.0	166.7
Md 600%	251.1	46.7	10.2	
Md 700%			11.1	
Tb(Kgf/cm ²)	342.2	67.8		233.3
EL(%)	650	650	1000<	570

	(1b)	(2b)	(3b)	(4b)
Md 100%	42.3	29.3	11.6	51.1
Md 200%	75.6	45.6	14.4	101.1
Md 300%	128.9	68.9	17.8	185.6
Md 400%	255.6	150.0	21.1	315.6
Md 500%			31.1	
Md 600%			40.0	
Md 700%				
Tb(Kgf/cm ²)	280.0	308.9	41.1	315.6
EL(%)	430	450	610	400

Note

	100°C × 40 min.	120°C × 30 min.
S=0.5, ZnO=5.0, BZ=0.25	1a	1b
S=3.0, ZnO=1.0, BZ=0.25	2a	2b
S=2.0, ZnO=0, BZ=0.25	3a	3b
S=2.0, ZnO=2.0, BZ=0.25	4a	4b



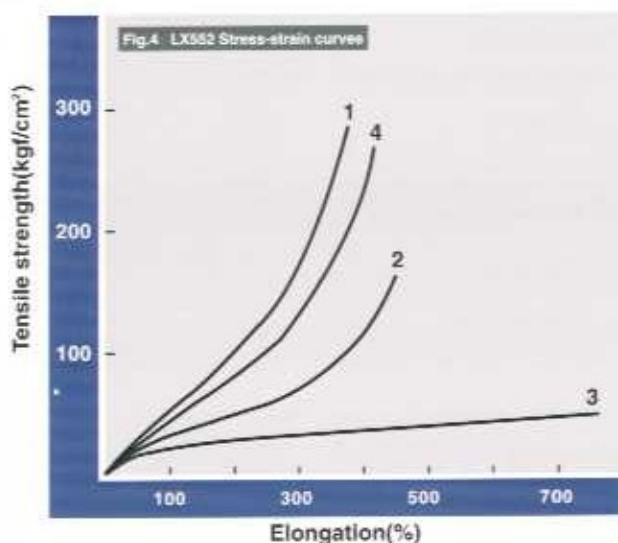
D. LX552 vulcanizing properties

All conditions are the same as those of LX550.

LX552 Vulcanization system and film properties

	(1)	(2)	(3)	(4)
Md 100%	34.5	21.0	14.0	27.3
Md 200%	62.5	30.5	23.5	49.8
Md 300%	108.5	45.5	29.8	77.5
Md 400%	180.0	70.0	32.0	125.3
Md 500%		114.0	36.42	58.0
Md 600%			41.0	
Md 700%			50.0	
Tb(Kgf/cm ²)	274.8	164.0	54.0	258.0
EL(%)	445	550	750	500

Note (1) S=0.5, ZnO=5.0, BZ=0.25
(2) S=3.0, ZnO=1.0, BZ=0.25
(3) S=3.0, ZnO=0, BZ=0.25
(4) S=2.0, ZnO=2.0, BZ=0.25



E.LX550L Compound recipe & process for examination thin glove

I. Formulation

(1) Compound recipe

NBR Latex LX550L 100 Dry parts

Note NH₄OH(10% >) or KOH(3% >) as required (pH 8.5-10)

(Curing ingredients : Total solid : 50%)

Sulfu 0.5~1.5 Parts

Zinc oxide (#1) 0.8~1.5

Titanium Dioxide 0.5~2.0

ZnBDC (BZ) 0.5

Dispersing agent 0.2

Stabilizing agent (KOH) 0.01~0.03

Note Latex compound : Total solids 30%
pH 8.5-10.0

(2) Film producing condition

Film is prepared by coagulant dipping method.

(Coagulant solutions)

Calcium nitrate 15-25 (20) parts

Water or Ethyl alcohol 83-70

Calcium carbonate 2-5

Wetting Agent 0.05

(3) Curing condition

Per-Dry Temp. = 80°C

Cure Temp. = 120°C × 20 min.

(4) Tensile strength test conditions

Film is cutting with dumb-bell test piece No.2

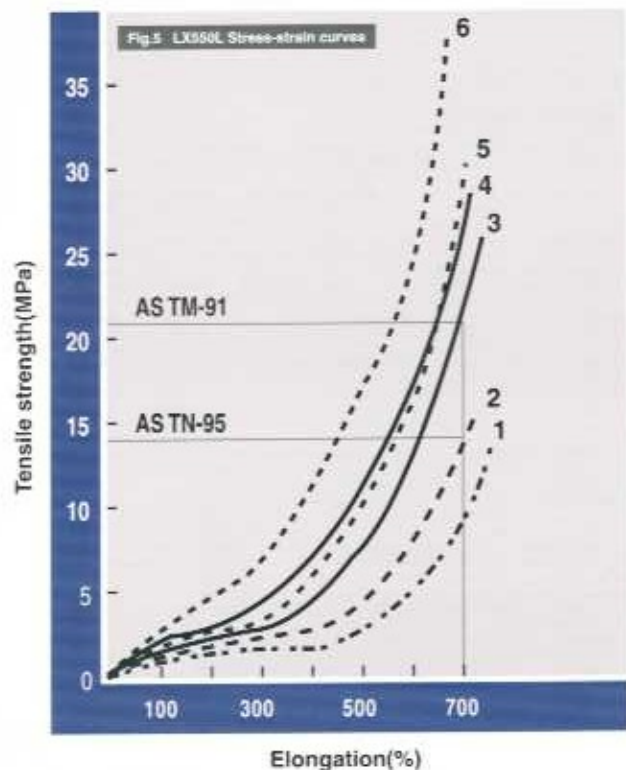
Numbers or sample : 4

Separation speed : 500 mm/min. (ASTM-D412)

LX550L Vulcanization system and film properties

	(1)	(2)	(3)	(4)	(5)	(6)
Md 100%	1.1	1.2	1.7	1.8	1.9	2.6
Md 300%	1.4	1.8	3.2	3.3	3.5	6.3
Md 500%	2.8	4.5	8.2	10.2	10.8	17.2
Md 600%	5.2	8.5	14.0	17.0	18.0	27.1
Md 700%	8.7	14.2	23.4	30.2	29.0	
Tb (MPa)	13.5	15.5	26.0	30.2	29.0	37.6
EL (%)	750	720	720	700	700	650

Note Latex compound : pH 8.5, BZ=0.5, TiO₂=0.7
(1) S=1.0, ZnO=1.0 (2) S=3.0, ZnO=1.0
(3) S=1.0, ZnO=1.25 (4) S=1.0, ZnO=1.5
(5) S=1.5, ZnO=1.5 (6) S=1.0, ZnO=2.5



ASTM No.	Item(Unit)	Before aging	After aging
ASTM-91	Tb(MPa)	21	16
	EL (%)	700	500
ASTM-95	Tb(MPa)	14	14
	EL (%)	700	500

II. Latex Compound (Example)

[A] Latex

	Dry parts	Wet parts
LX550L	100	222
H ₂ O		111
Total		333

Total solids :30%, pH 9-10 adjustment : NH₄OH (10%) or KHO (3%)

[B] Curing agent : Ball-mill mixing 48 hrs

		Dry parts	Wet parts
ZnO (#1)	Powders	1.25	1.25
S	Powder	1.0	1.0
ZnBDC (BZ)	Powder	0.5	0.5
TiO ₂	Powder	0.7	0.7
NASF	45%	0.2	0.44
KOH	3%	0.03	1.0
H ₂ O			2.47
Total		3.68	7.36

※ Total solids : 50%

[LX Compound]

Mixing time : 2hrs , maturing : 3~4days

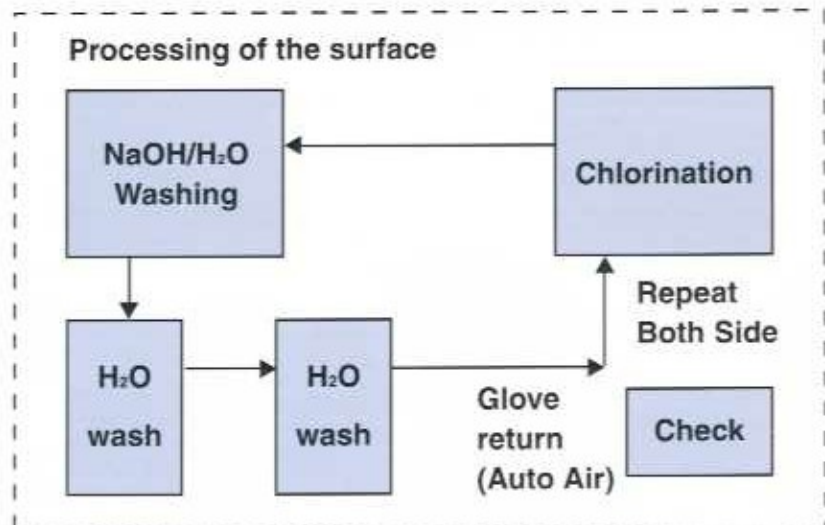
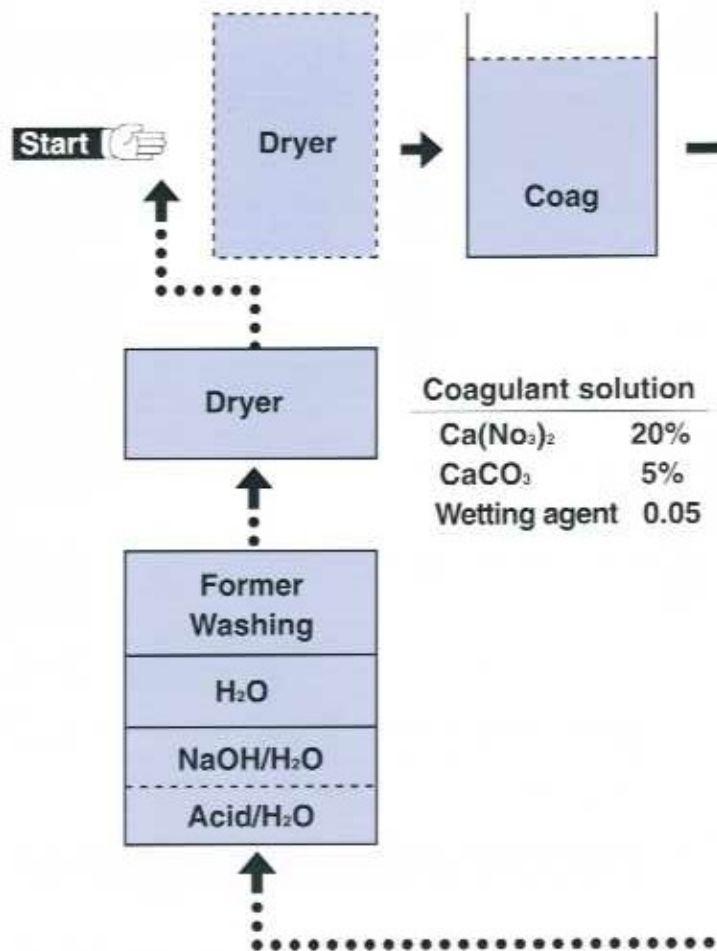
		Dry parts	Wet parts
[A] Latex	30%	100	333
[B] Curing agent	50%	3.68	7.36

Defoamer※

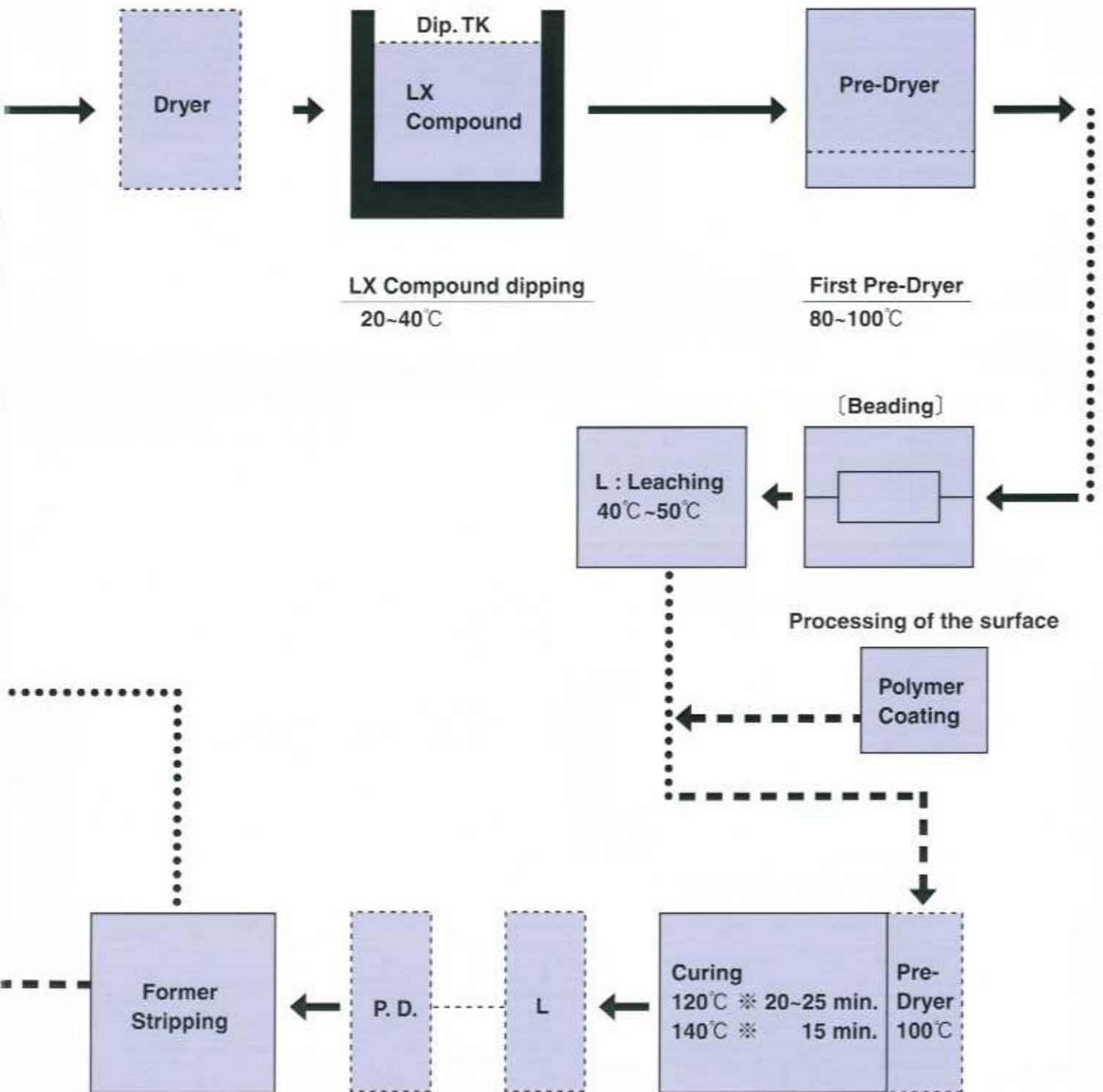
Total solids :30%, pH 9-9.5 adjustment : KHO (3%)

※ at mixing and before dipping

III. Dipping Process (Continuous line)

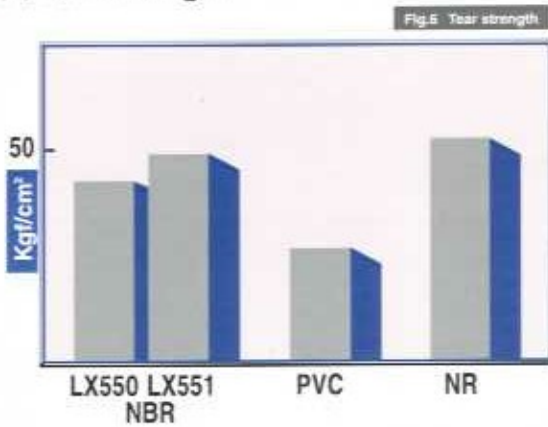


NBR LATEX FOR GLOVES

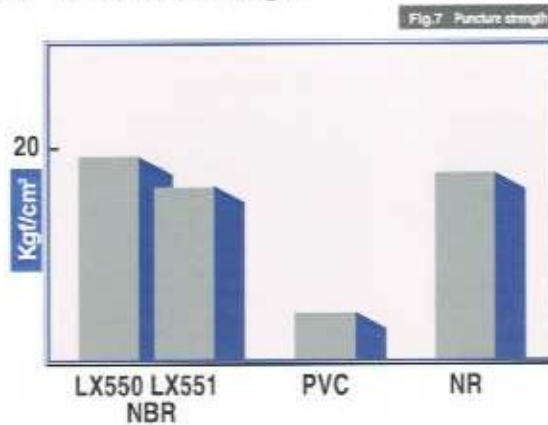


F. Evaluation for industrial glove

(1) Tear strength



(2) Puncture strength



(3) Resistance to abrasion

Material	LX550	LX551	NR	PVC	PVC soft type
	○	○	×	⊙	○

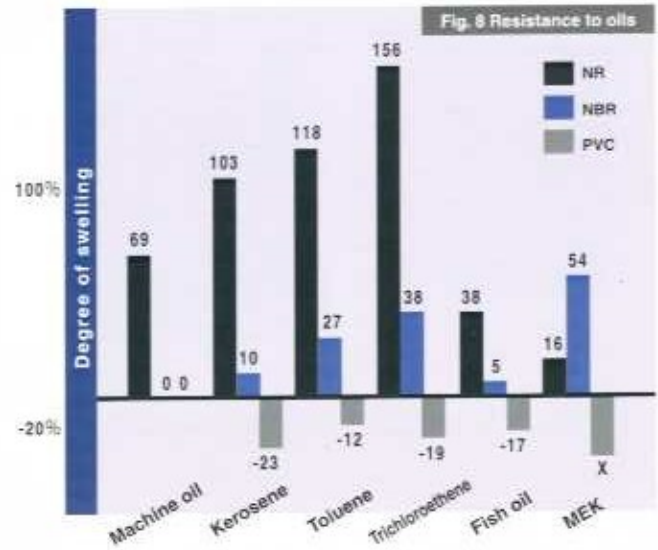
Note: ⊙Excellent ○Good △Fair ×Poor

(4) Low temperature flexibility

Temperature	LX550	LX551	NR	PVC	PVC soft type
20°C	○	○	⊙	⊙	⊙
0°C	○	○	⊙	○	⊙
-10°C	△	△	⊙	△	⊙

Note: ⊙Excellent ○Good △Fair ×Poor

5) Resistance to oils



5) Resistance to oils and chemicals

Chemicals	Functional Grope	NBR		NR		PVC	
		Non-swell	Dura-bility	Non-swell	Dura-bility	Non-swell	Dura-bility
Acetaldehyde	-CHO	G	G	G	E	E	G
Formaldehyde		G	G	G	E	F	G
Acetic acid	-COOH	G	G	G	G	F	P
Acrylic acid		G	G	G	G	F	P
Lauric acid		G	G	G	G	F	P
Acetonitrile	-CN	F	F	G	G	P	P
Aniline	-NH2	F	F	G	G	G	G
Dimethylamine		F	F	G	G	G	G
Carbontetrachloride	-Cl	G	G	F	F	P	F
Chlorobenzene		G	G	F	F	F	G
Perchloroethylene		G	G	F	F	P	F
Methylenechloride		G	G	F	F	P	F
DMSO	-SO-	E	E	E	E	G	G
MEK	-CO-	F	F	E	E	VP	VP
Ethyl acetate	-COO-	G	F	G	G	P	P
Nitrobenzene	-NO2	F	F	G	G	VP	VP
Benzene		F	F	P	P	P	F
Toluene		F	F	P	P	P	G
Styrene		F	F	P	P	P	G
THF	-CH=CH-	F	F	P	P	VP	VP
Ethy alcohol	-O-	F	F	P	P	P	VP
Ethylene glycol	-OH	G	E	G	E	P	F
Hexane		G	E	G	E	E	E
Kerosene		G	E	P	F	P	P
Gasoline		G	E	P	F	P	P
Turpentine oil		G	E	F	F	G	E
Fish oil		G	E	F	F	G	E
JIS OIL3		E	E	P	G	E	E
Nitric acid		P	F	G	E	G	E
Sulfuric acid		F	F	E	E	G	G
Chloric acid mixture		E	G	E	E	E	E
Chloric acid		G	G	G	E	G	E
Sodium hydroxide		G	G	G	E	G	E

Note: E=Excellent G=Good F=Fair P=Poor VP=Very Poor

Disclaimer of liability

To the best of our knowledge, the information contained herein is accurate.

However, to the extent that any of the information contained herein was provided by a source other than Zeon Corporation, we cannot guarantee the accuracy of that information. Please be advised that the final determination of the suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution.

Although certain hazards are described herein, Zeon Corporation cannot guarantee that these are the only hazards which may exist.

The suggestions contained herein for the use of our products are based on tests that we believe are reliable. However, due to variations in customer handling and methods of compounding, we cannot guarantee that the same results will be obtained, nor do we assume any liability for the use by a customer of any materials in violation of patent rights.

PRECAUTIONS

Read the Material Safety Data Sheet prior to handling for recommended protective equipment and detailed hazard and precaution information.

Safety Precautions

- ◇ Wear goggles or safety glasses.
- ◇ Wear protective overalls and use rubber or plastic gloves.
- ◇ Provide adequate ventilation during drying and processing.
- ◇ Inhalation of the product may cause headaches, dizziness, nausea, or vomiting.
- ◇ Ingestion of latex products may cause irritation to mucous membranes and make breathing difficult.

First Aid

EYE CONTACT : Flush with water for at least 15 minutes. Get medical attention.

SKIN CONTACT : Wash thoroughly with soap and water. If irritation persists, get medical attention.

INHALATION : Remove to fresh air. If breathing is difficult, give oxygen.

INGESTION : Rinse mouth with water and induce vomiting. Get medical attention.

Handling Precautions

- ◇ Avoid exposure to freezing or direct sunlight.
- ◇ Keep containers tightly closed. Store at temperatures between 5°C to 40°C.
- ◇ Dispose of in accordance with all applicable regulations.
Do not flush latex products into sewers or natural waters.



ZEON

 **ZEON CORPORATION**

A D R E S S : FURUKAWA SOGO BLDG, 2-6-1, MARUNOUCHI,
CHIYODA-KU, TOKYO, JAPAN

PHONE : +81-3-3216-1947

F A X : +81-3-3216-0504