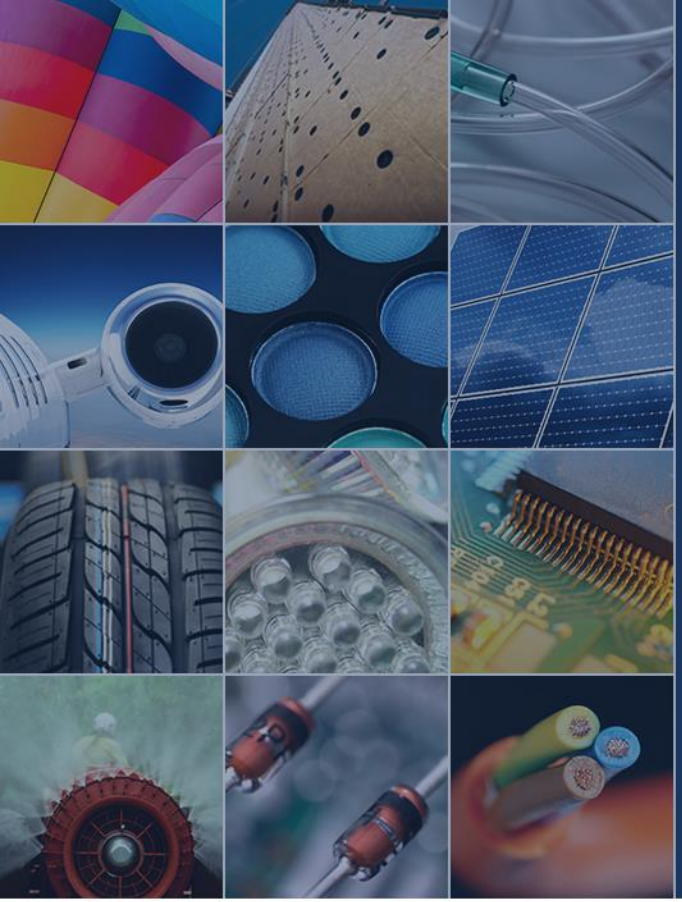


MOMENTIVE™
inventing possibilities

Elastomers Healthcare Overview

INTRODUCTION TO MOMENTIVE

INDUSTRY LEADER

Global Capability

- 29 technology centers
- 5,000 associates
- 8,700 customers

MOMENTIVE™
inventing possibilities

TRANSFORMATIONAL COMBINATION FORGES AN INDUSTRY LEADER

MOMENTIVE performance materials
GE Bayer Silicones
TOSHIBA
GE Sealants & Adhesives
OSi SPECIALTIES

BUSINESS UNITS (BUs)

Momentive Performance Materials Inc. (MPM)

SILICONES & QUARTZ DIVISION

ADDITIVES SECTOR

Silanes Business Unit
- Coatings, Adhesives & Sealants
- Tire & Rubber
- Industrial
- High Performance Polymers

Specialty Fluids Business Unit
- Personal & Home Care
- Agriculture
- Oil & Gas
- Textiles, Leather & Nonwoven
- Industrial

Urethane Additives Business Unit
- Molded Foam
- Slab Foam
- Rigid Foam
- Specialties

BASICS SECTOR

Basic Fluids Business Unit

FORMULATED PRODUCTS SECTOR

Coatings Business Unit
- Hardcoats & Weatherstrip
- PSA & Release Coatings

Elastomers Business Unit
- LSR
- Custom Compounds
- HCR

Electronics Business Unit
- Consumer & Industrial Electronics
- Optical
- Industrial RTV

Sealants Business Unit
- Consumer
- Construction

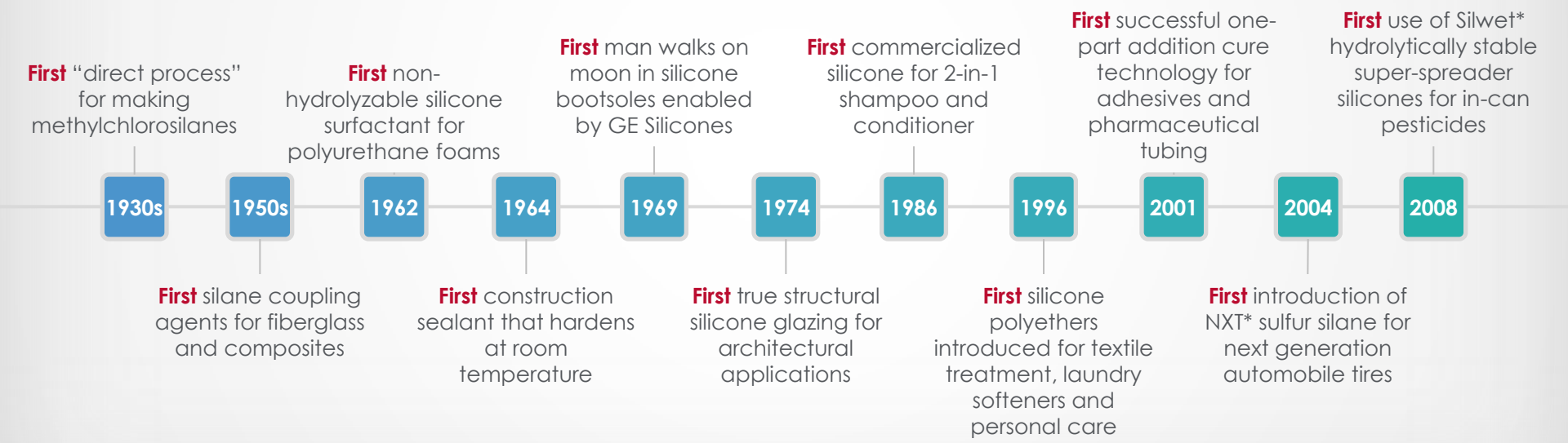
QUARTZ & CERAMICS SECTOR

Ceramics Business Unit

Quartz Business Unit

INNOVATIONS AND MARKET FIRSTS

Industry Leadership through 75 Years of Silicone Innovation



*NXT and Silwet are trademarks of Momentive Performance Materials Inc.

ELASTOMERS BUSINESS OVERVIEW

MOMENTIVE™

ELASTOMERS

Portfolio Description

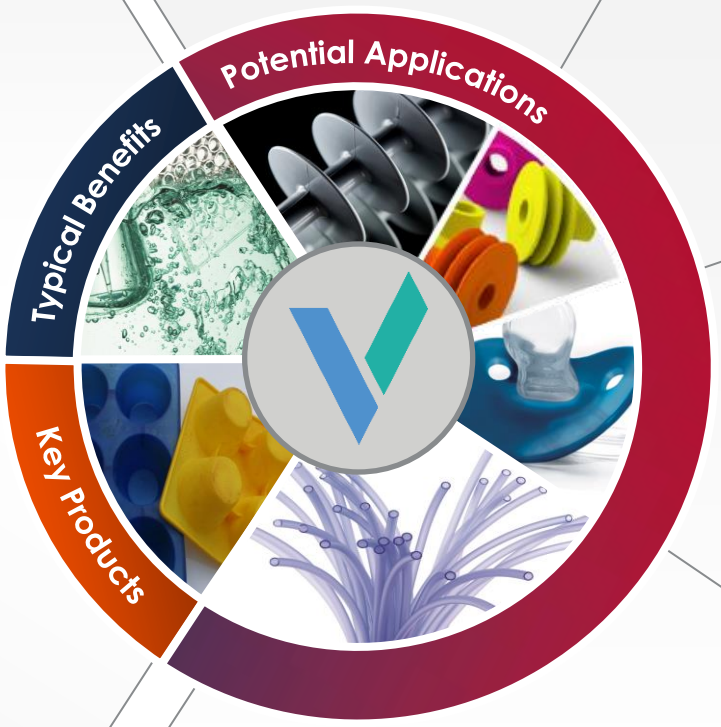
Sold to OEMs, molders and fabricators that are either supplying to assemblers or are partially forward-integrated to assemble parts for the transportation, energy, healthcare and consumer industries

MOMENTIVE™

ELASTOMERS

POTENTIAL APPLICATIONS, KEY PRODUCTS & TYPICAL BENEFITS

- Excellent heat resistance
- Weathering resistance
- Special electrical properties
- Oxygen permeability
- Sensory enhancement
- Rapid cure
- Chemical resistance
- High clarity
- Adhesion
- Regulatory compliance



ENERGY

- High-voltage insulators
- Cable accessories and cable joints
- Surge arrestors
- Wire and cable

TRANSPORTATION

- Gaskets
- O-Rings
- Hoses
- Connector seals
- Sparkplug boots
- Fuel and oil system valves
- Air management system gaskets
- Profiles (aerospace)

CONSUMER

- Infant care
- Bake ware
- Gaskets
- Cubes
- LED lenses/lighting
- Mobile phones/portable electronic devices
- Computers/laptops
- Displays and projectors
- Keypads and printer rollers

HEALTHCARE

- Tubing
- Catheters
- Wound dressings
- Dialysis O-Rings
- Respiratory/anesthesia
- Fluid and drug delivery devices
- Orthopedics/prosthetics
- Wound drains and bulbs
- Pharmaceutical closures/stoppers
- Dental/surgical devices
- Diagnostics/imaging

Categories:

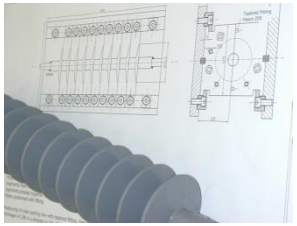
- Liquid Silicone Rubber (LSR)
- Heat Cured Rubber (HCR)
  - Customized solutions
  - HCR base grades
- Primers for LSR and HCR
- Color paste

Sub-categories:

- Addition cure
- UV-cure-on-command
- Fluorosilicones
- Ultra-clear
- Self-bonding
- Self-lubricating
- Electrically conductive
- Anti-microbial

MOMENTIVE APPLICATION DEVELOPMENT CENTERS

- Our ADCs provide state-of-the-art technical and managerial support, especially for new technologies



ADC Leverkusen, Germany

- The technical centers work in a worldwide network furnishing Momentive Performance Materials customers:

- tools and technical advice available in their industries
- process modeling
- prototyping
- productivity analysis and troubleshooting
- network to mold makers and equipment suppliers

ADC Shanghai, China

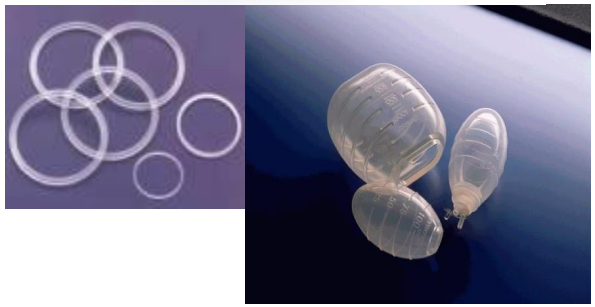
MOMENTIVE™

SILICONES PORTFOLIO FOR HEALTHCARE

MOMENTIVE™

LIQUID SILICONE RUBBERS (LSR/LIM) FOR HEALTHCARE

- Biocompatible
- Broad Range of Durometers (5 to 80 shore A)
- Fast cure/High tear
- Specialty/Custom Offerings
  - Antimicrobial
  - UV curable
  - Ultra Clear
  - Radio-Opaque
  - Self-Bonding
  - Reduced Self Healing
  - Antistatic
  - Fiber Reinforced
  - Colors
  - Miscellaneous Additives
- Excellent Resistance to Sterilization



MOMENTIVE™

LIQUID SILICONE RUBBERS (LSR/LIM)

LIM* 60X0 series

> Biocompatible (USP Class VI)[1]
> Broad range of durometers from 10 to 70 shore A
> **Fast cycle times**
> High tear strength

Self bonding

> LIM8040, CLS5000, LSR2740
> Biocompatible (USP Class VI)[1]
> **Adhesion to plastic and metal**
> Easily pigmentable
> Shore A of 40 and 67
> Customization available

LSR2003– Low Duro

> Biocompatible (USP Class VI) [1]
> **Low durometer of 5 shore A**
> Low viscosity vs. standard LIM/LSR

LSR 20X0/40X0 series

> Biocompatible (USP Class VI/ISO10993)[1]
> Broad range of durometers from 20 to 80 shore A
> **Higher clarity vs. LIM6000 series**

LSR 26X0/46X0 series

> Biocompatible (USP Class VI)[1]
> Broad range of durometers from 20 to 70 shore A
> **Fast cycle times**
> **High tear**
> Low viscosity

LSR Topcoat

> Biocompatible (USP Class VI)[1]
> **Lowers coefficient of friction**
> Reduces dust pick up
> Provides soft, slippery feel

[1]USP Class VI equivalent tests were tested according to USP Class VI methods

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LIQUID SILICONE RUBBERS (LSR/LIM)

Product Name	USP Class VI	ISO10993	BfR	FDA Indirect Food Contact	European Pharmacopia	Appearance	Density g/cm3	Hardness/Durometer Shore A	Tensile Strength Mpa	Elongation %	Tear Strength, Die B N/mm	Compression Set % (post cured)
General Purpose												
LSR 2003	•	•	○	x	–	Transparent	1.05	50*	3	500	4	20
LSR 2010	•	•	○	•	–	Transparent	1.07	8	3	970	6	15
LSR 2020	•	•	○	•	–	Transparent	1.08	22	6	1000	15	20
LSR 2030	•	•	○	•	•	Transparent	1.1	31	8	800	18	15
LSR 2040	•	•	○	•	•	Transparent	1.12	40	9	750	25	25
LSR 2050	•	•	○	•	•	Transparent	1.12	51	10	600	35	25
LSR 2060	•	•	○	•	•	Transparent	1.13	60	10	450	30	25
LSR 2070	•	•	○	•	•	Transparent	1.14	70	9	400	20	25
LSR 2080	•	•	○	•	•	Transparent	1.13	79	7	150	5	25
Fast Cure, High Tear												
LSR 2630	•	•	○	•	–	Transparent	1.1	32	8	700	35	15
LSR 2640	•	•	○	•	–	Transparent	1.12	42	8	600	40	25
LSR 2650	•	•	○	•	–	Transparent	1.12	52	10	550	50	25
LSR 2660	•	•	○	•	–	Transparent	1.13	62	9	400	45	20
LSR 2670	•	•	○	•	–	Transparent	1.13	69	9	350	30	20
LIM 6010	•	•	○	○	–	Transparent	1.05	15	3	440	10	
LIM 6030	•	•	○	•	–	Transparent	1.12	35	9	675	31	
LIM 6040	•	•	○	•	–	Transparent	1.12	42	9	600	39	
LIM 6050	•	•	○	•	–	Transparent	1.12	53	9	530	43	
LIM 6061	•	–	○	•	–	Transparent	1.12	60	9	400	36	
LIM 6071	•	–	○	•	–	Transparent	1.12	70	7	330	36	

○	product is compositionally compliant
x	does not meet the requirements of Rubber Articles Intended for Repeated Use 21 CFR 177.2600
•	Meets the requirments for passing the test standard
*	Tested using Shore 00 scale
–	Not tested

MOMENTIVE™

LIQUID SILICONE RUBBERS (LSR/LIM)

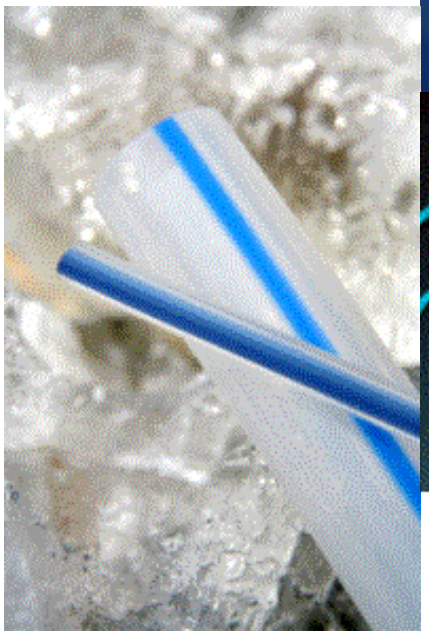
Product Name		USP Class VI	ISO10993	BfR	FDA Indirect Food Contact	European Pharmacopia	Appearance	Density g/cm3	Hardness/Durometer Shore A	Tensile Strength Mpa	Elongation %	Tear Strength, Die B N/mm	Compression Set % (post cured)
Self-Bonding													
LIM* 8040		•	–	–	–	–	Translucent	1.08	43	5	390	37	>50
CLS 5000		•	•	–	–	–	Translucent	1.12	67	11	460	44	–
LSR 2740		•	•	–	•	–	Translucent	1.12	40	10	700	15	25
CLS 8150		•	–	–	–	–	Translucent	1.1	52	8	515	34	–
Healthcare - Radio Opaque (x-ray detectability)													
LIM 6041		•	–	•	•	–	White	1.19	45	7	700	32	–
High Clarity LSR													
LSR 7070		•	•	–	•	–	Optically Clear	1.05	70	10	150	10	–

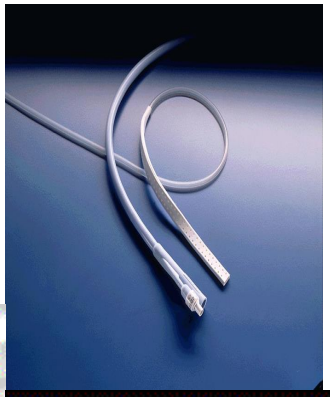
•	meets the requirments for passing the test standard
–	not tested
o	compositionally compliant

MOMENTIVE™

HIGH CONSISTENCY ELASTOMERS FOR HEALTHCARE

- Biocompatible Peroxide and Platinum Curable Elastomers
- Broad Range of Durometers
- Catalysts Optimized for Extrusion and Molding Processes
- One Component, Ready to Use Options Available
- Product Offerings with Enhanced Mechanical Performance
  - High Tear
  - Low Hysteresis
  - High Bayshore Resilience
  - Low Compression Set
- Specialty/Custom Offerings
  - Antimicrobial
  - UV curable
  - Radio-Opaque
  - Anti-static
  - Colors
  - Miscellaneous Additives
- Excellent Resistance to Sterilization





MOMENTIVE™

HEAT CURABLE ELASTOMERS (PLATINUM CURE SYSTEM)

Tufel* (94X00U)

> Some grades tested for biocompatibility (USP Class VI)[1]
> High tear strength
> Tight surface cure
> 99:1 ration of base compound to catalyst
> Optimized for molding (CA-4), extrusion or calendaring (CA-2)

Ultra Tufel* (96X05,96X06)

> Biocompatible (USP Class VI)[1]
> 40, 50, and 60 durometer
> High tear strength
> Low volatile, low porosity
> **Excellent transparency**
> Lower temperature cure
> 99:1 ratio of base compound to catalyst
> Optimized for molding (CA-5) ,extrusion or calendaring (CA-6)

Tufel*I (91X06)

> Biocompatible (USP Class VI)[1]
> **One component system**
> Broad range of durometers from 20 to 70 shore A
> Translucent, low volatile, high tear strength
> Optimized for molding,extrusion, or calendaring (patented Addisil catalyst technology)

Tufel* II (94X05, 94X06)

> Biocompatible (USP Class VI)[1]
> Broad range of durometers **20 to 70 shore A**
> High tear strength
> **Low volatile, low porosity**
> Good transparency
> Lower temperature cure
> 99:1 ratio of base compound to catalyst
> **Optimized for molding (CA-5) ,extrusion or calendaring (CA-6)**

Tufel*III (92506, 92656)

> Biocompatible (USP Class VI)[2]
> 50 and 65 durometer
> **Low compression set**
> **High resiliency**
> **Low hysteresis**
> Excellent pump life performance
> Translucent, low volatile
> General purpose tear strength
> 99:1 ratio of base compound to catalyst
> Optimized for molding (CA-5) ,extrusion or calendaring (CA-6)

Addisil*

> Biocompatible (ISO10993)[1]
> 1:1 mix ratio or one component
> Broad range of durometers from 40 to 70 shore A
> High Transparency
> High tear strength, High elongation
> Optimized for molding,extrusion, or calendaring (patented Addisil catalyst technology)

Tufel* III and Addisil* available in UV cure

[1]USP Class VI equivalent tests were tested according to USP Class VI methods

HEAT CURABLE ELASTOMERS (PLATINUM CURE SYSTEM)

Typical Properties

Product Name		USP Class VI	ISO10993	BfR	FDA Indirect Food Contact	European Pharmacopia	Appearance	Density g/cm3	Hardness/Durometer Shore A	Tensile Strength Mpa	Elongation %	Tear Strength, Die B N/mm
TUFEL* II Platinum Catalyzed, Low Volatile												
9420X		•	–	o	•	–	Translucent	1.07	22	8.2	1000	22
9430X		•	–	o	–	–	Translucent	1.1	28	9.3	1050	30
9440X		•	–	o	–	–	Translucent	1.11	43	9.6	780	40
9450X		•	–	o	–	–	Translucent	1.15	52	9.7	880	47
9560X		•	–	o	–	–	Translucent	1.19	62	8.6	690	46
9470X		•	–	o	–	–	Translucent	1.22	74	9.2	580	57
TUFEL* III Platinum Catalyzed, High Resilience, Low Hysteresis												
92506		•	•	–	o	–	Translucent	1.12	50	7.6	500	18
92656		•	•	–	•	–	Translucent	1.14	65	8.9	350	21

•	meets the requirments for passing the test standard
–	not tested
o	compositionally compliant

HEAT CURABLE ELASTOMERS (PEROXIDE CURE SYSTEM)

Typical Properties

Product Name		USP Class VI	ISO10993	BfR	FDA Indirect Food Contact	European Pharmacopia	Appearance	Density g/cm3	Hardness/Durometer Shore A	Tensile Strength Mpa	Elongation %	Tear Strength, Die B N/mm
SILPLUS* Peroxide Catalyzed, Multi-Purpose												
40 MP		•	•	o	•	–	Translucent	1.12	40	9	700	17
50 MP		•	•	o	•	–	Translucent	1.15	50	11	550	25
60 MP		•	•	o	•	–	Translucent	1.17	60	11	500	28
70 MP		•	•	o	•	–	Translucent	1.21	70	11	420	30
80 MP		•	•	o	•	–	Translucent	1.19	78	10.5	350	22
SILPLUS* Peroxide Catalyzed, Extrusion												
40 EX		•	•	o	•	–	Translucent	1.14	44	11	600	24
60 EX		•	•	o	•	–	Translucent	1.19	62	11	500	25
80 EX		•	•	o	•	–	Translucent	1.24	80	10	440	28
SILPLUS* Peroxide Catalyzed, High Strength												
30 HS		•	•	o	•	–	Translucent	1.1	30	9	1100	30
40 HS		•	•	o	•	–	Translucent	1.12	40	11	1000	35
50 HS		•	•	o	•	–	Translucent	1.13	50	12	750	40
60 HS		•	•	o	•	–	Translucent	1.16	60	12.5	700	40
70 HS		•	•	o	•	–	Translucent	1.18	70	11.5	600	45
70 HS		•	•	o	•	–	Translucent	1.2	80	11	450	40
Specialty Peroxide Catalyzed, Excellent Pump Life												
SE4524U		•	–	–	•	–	Translucent	1.15	50	9	600	37

•	meets the requirments for passing the test standard
–	not tested
o	compositionally compliant

SPECIALTY LSR AND NEW TECHNOLOGY DEVELOPMENTS FOR HEALTHCARE

- SELF LUBRICATING LSR
- SELF BONDING LIM/LSR- PC & TRITAN
- REDUCED SELF HEALING LSR
- FAST CURE LSR
- ULTRA CLEAR LSR
- UV CURABLE LSR
- LSR TOPCOAT
- ANTIMICROBIAL LSR

MOMENTIVE™

SELF LUBRICATING LSR FOR HEALTHCARE

MOMENTIVE™

LSR4655SL (Self Lubricating LSR for Healthcare)

Features and properties

- ISO10993 and USP Class VI compliant.
- Lubricious surface enables automated assembly of devices and use activation.
- Robust self-lubricating performance – longevity of molded articles.
- Customizable bleed rate

	LSR4655SL
Shore A	55
Tensile Strength (MPa)	8
Elongation $_{max}$ [%]	500
Tear Strength [N/mm]	42

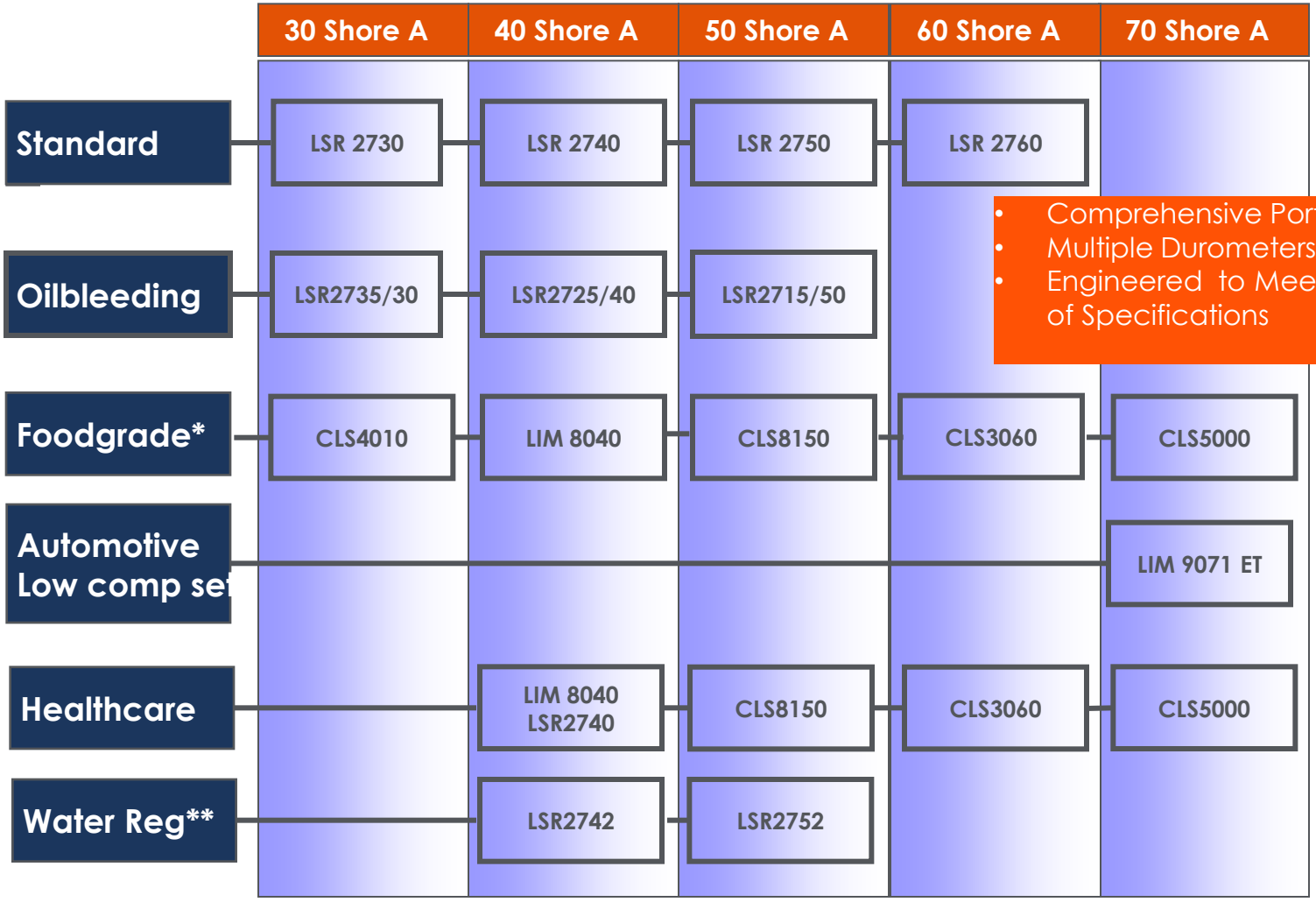
Applications

- Needle-free access valves
- O-rings, stoppers and seals
- Other healthcare parts requiring assembly

MOMENTIVE™

SELF BONDING LSR

SELF BONDING LSR PORTFOLIO

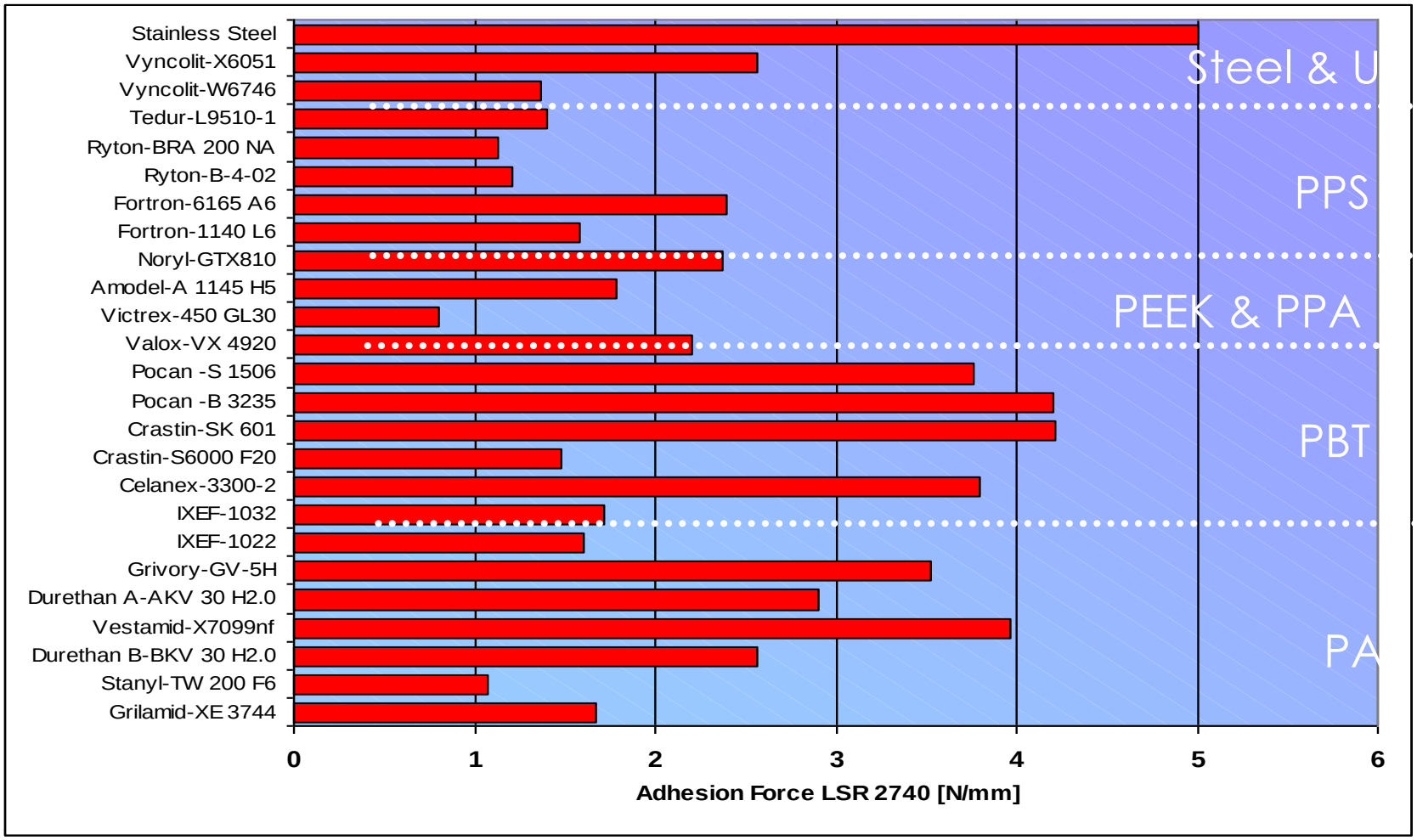


*Provided sufficiently post cured & application specific

** KTW & W270

MOMENTIVE™

ADHESION TO ENGINEERING THERMOPLASTICS



PRIMERLESS ADHESION TO TRITAN AND PC SUBSTRATES IN DEVELOPMENT

MOMENTIVE™

ADHESION TO POLYCARBONATE WITH PLASMATREAT

	LSR 2740	
	24h/RT N/mm	4h/100°C N/mm
Lexan HPX4	4,0	6,0
Lexan 940A110	5,0	6,0
Makrolon 2458	4,9	6,0
Makrolon 2407	4,9	6,0
Apec 1745 HT	5,3	5,6
Lexan 4504 HT	6,5	5,4

* Values shown are average
** Polycarbonate samples were Plasma treated just before overmolding
*** Batch of Silopren LSR 2740 VCA9043
**** Molding conditions PC: TempMold = 130°C; Curing Time = 120 s
***** Molding conditions PC-HT: TempMold = 150°C; Curing Time = 75 s

REDUCED SELF HEALING LSR

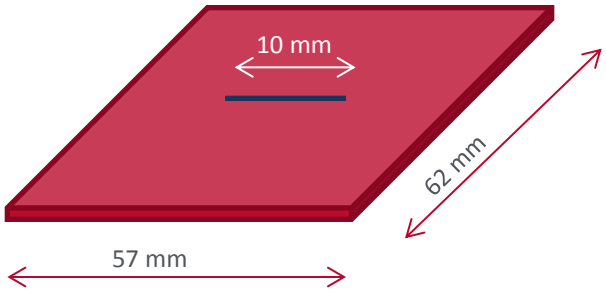
LSR 2040 RSH Reduced Self Healing Liquid Silicone Rubber

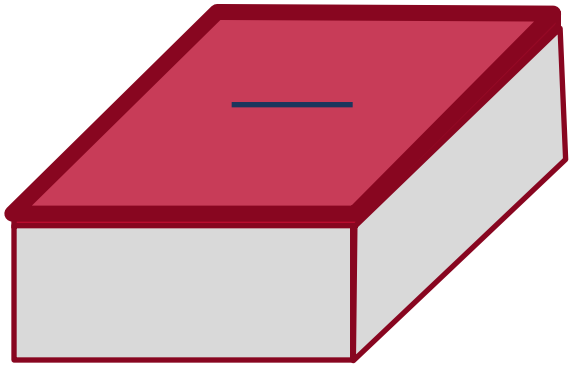
Slit Crack Simulation in Momentive's ADC Lab

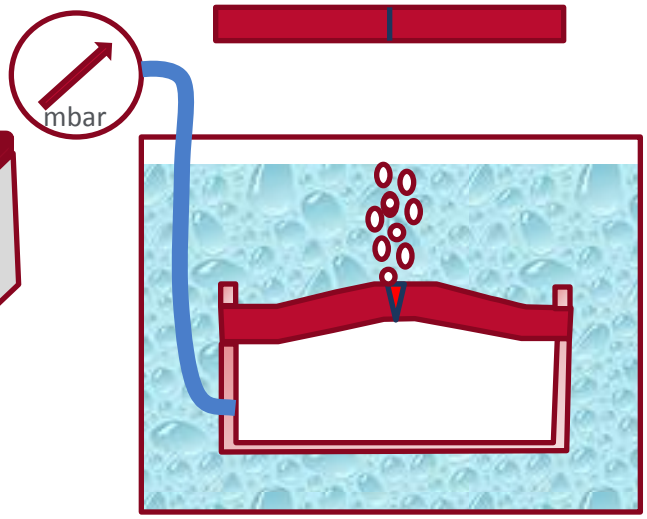
Test sheet.
Injection molding of sheet (2 mm thick)
ϑ_{mold} = 175°C, 25 sec
Apply defined slit (10 mm) 60 min after molding

Preparation
Fix sheet on pressure chamber

Test
Apply air pressure in water bath
Record pressure when slit opens







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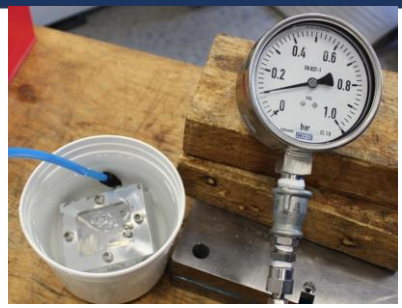
LSR 2040 RSH REDUCED SELF HEALING LSR



Testing Overview

Test of 2 base materials:

LSR 2040 standard

LSR 2040 RSH material

Measure:

Injection molded test sheets => Slit 10 mm long direct after demolding

Burst Pressure Results (reported in bar)

Material	Storage	0 h	3 d	7d	14 d
2040 13GLVL148	23°C	0,01	0,05 0,1 0,05	0,06 0,06 0,06	0,05 0,1 0,2
	75°C	0,01	0,05 0,02 0,05	0,2 0,1 0,1	0,3 0,1 0,2
2040 RSH 14ALVL596	23°C	0,01	0,01 0,01 0,01	0,01 0,01 0,01	0,02 0,05 0,02
	75°C	0,01	0,02 0,05 0,02	0,01 0,01 0,01	0,05 0,02 0,02

80% LESS PRESSURE NEEDED TO OPEN SLIT WITH LSR 2040 RSH

MOMENTIVE™

PRODUCT OVERVIEW of LSR 2xxx RSH

Silopren* RSH Product	Typical Properties							Regulations		
	Hardness Shore A	Tensile Strength N/mm²	Elongation %	Tear Strength N/mm	Density g/cm³	Compression Set %	Appearance	FDA	Biocompatibilties	BfR
LSR 2040 RSH*	40	10.5	700	30	1.12	25	Translucent	Y	Testing	O*
LSR 2650 RSH	51	10.0	550	45	1.12	25	Translucent	Testing	Testing	O*
LSR 2640 RSH	41	8.0	600	35	1.11	20	Translucent	Testing	Testing	O*

Remark *

- O*: The ingredients are listed in the BfR recommendation XV "Silicones“
- * According to Momentive internal specifications, non post cured LSR 2040 RSH also demonstrates equivalent performance on physical properties to post cured materials

FAST CURE LSR

MOMENTIVE™

LOW TEMPERATURE FAST CURE LSR

Silopren LSR4640FC

Potential Applications:

Respiratory masks
Fluid & drug delivery
Wound drain bulbs
Thermoplastic overmold

Features and Benefits

- Fast cure at low temperatures
- High Tear Strength
- Biocompatibilty
- Manufacturing productivity gains
- Improved chemical / cleaning agent resistance
- Co-mold with lower melt temp thermoplastics such as PC

LSR 7000 SERIES ULTRA CLEAR LSR

ULTRA CLEAR LIQUID SILICONE RUBBER

Ultra Clear Silopren* LSR7000 Series
Key Features and Advantages

Optical Clarity

LSR 7000 is a highly transparent material with excellent typical values in transmission, haze and dispersion as compared to those of plastics.

- 94% transmission
- <1% haze
- Abbe number of approximately 50
- Strong color stability

Durability

High temperature and UV light resistance coupled with resistance to even the smallest cracks makes LSR 7000 a durable material. Its ability to retain good optical properties, even in challenging conditions, allows it to meet the demanding requirements of most innovative applications.

- High temperature resistance even above 150 °C
- UV light resistance
- Micro-crack resistance

Design Freedom

The most innovative ideas can be realized with LSR 7000. Due to its high flowability, the material can help enable increased precision and the ability to design complex and micro-structure parts.

- Enhanced options for part integration
- Reduced weight in design

Productivity

Reproduction of optical parts is clearly a critical factor in material selection. LSR 7000 can enable reliable mass production processes with minimized waste, high yield and easy manufacturing.

- Excellent processability for injection/compression moldability
- Material waste may be minimized in the coldrunner-based LSR injection process

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ULTRA CLEAR LIQUID SILICONE RUBBER

Ultra Clear Silopren* LSR7000 Series
Comparison with other transparent materials

Category	Property	LSR 7000	PC	PMMA	Glass
Properties of Optical Clarity, 2 mm	Transmission [%]	94	86~89	89~92	92
	Index of Refraction (RI)	1.41	1.59	1.49	1.5~1.6
	Haze %	<1	1-3	2-4	-
	Abbe number	50	34	57	39~59
	Yellowness index	<1	1.0~3.0	1.0~3.0	-
Durability	Heat resistance	Excellent	Poor	Poor	Excellent
	UV resistance	Excellent	Poor	Good	Excellent
Design Freedom	Complex/micro-design	Excellent	Good	Good	Poor
	Material flexibility	Excellent	Poor	Poor	Poor
	Light weight design	Excellent	Good	Good	Poor

Figures may vary by specific grades. Typical product data values are averages and should not be used as specifications.

LSR 7000 is an optical enabler
for high durable and micro-structure/complex design applications

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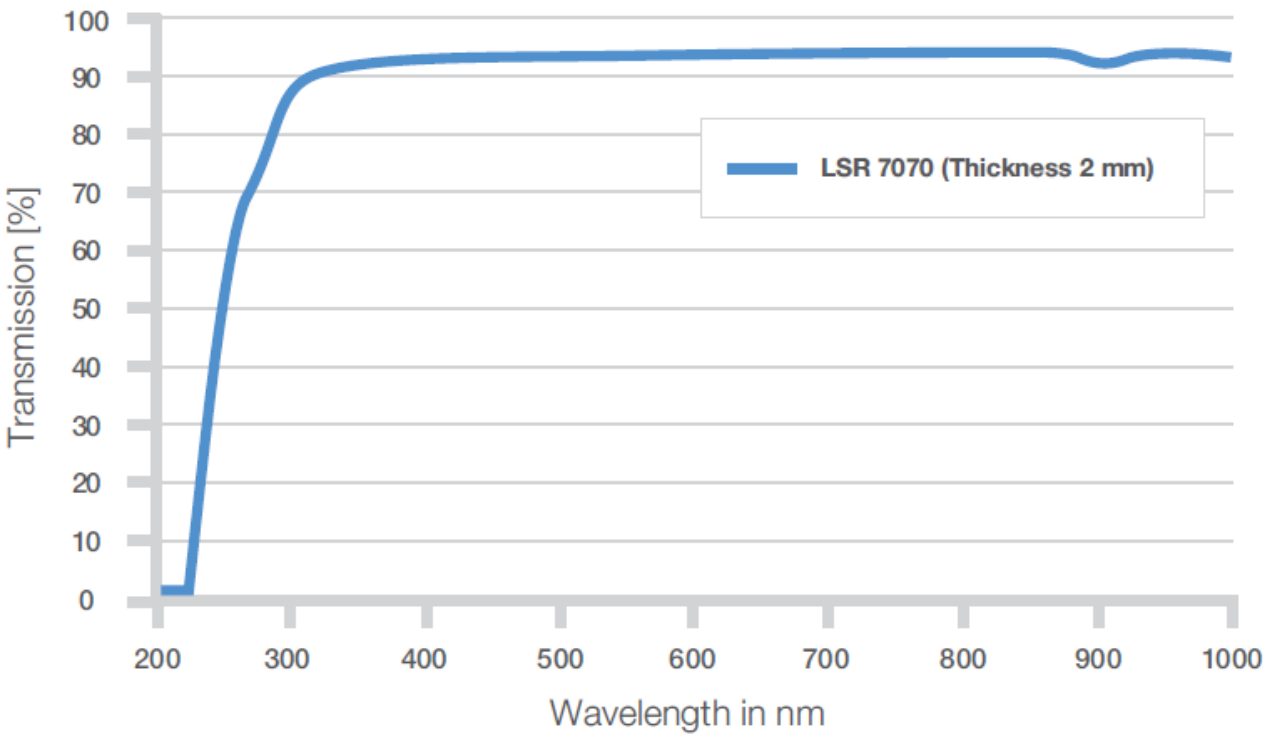
ULTRA CLEAR LIQUID SILICONE RUBBER

Ultra Clear Silopren* LSR7000 Series
Optical Clarity



Transmission

The Silopren LSR 7000 series features a consistent transmission level of approximately 94 % at 2 mm over a wide range of wavelengths in both visible and non-visible light.

Higher and even light transmission over a wide range of wavelengths = high light output

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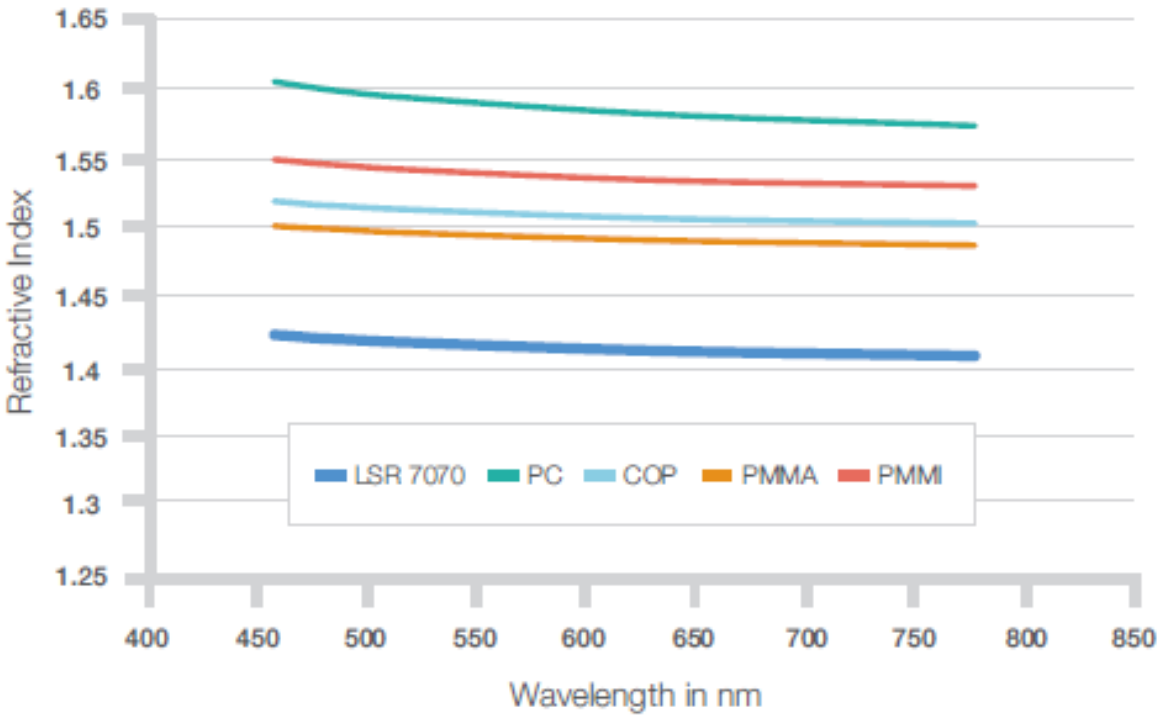
ULTRA CLEAR LIQUID SILICONE RUBBER

Ultra Clear Silopren* LSR7000 Series
Optical Clarity



Refractive Index

The Refractive Index (RI) is important for many optical applications. The RI is directly influenced by the thermal expansion of the molded part with RI decreasing as the temperature of the part increases. The LSR 7000 series typically has a lower RI than common thermoplastics; with an appropriate lens design, performance similar to thermoplastics can easily be exceeded.

Low dispersion, reduced chromatic aberration

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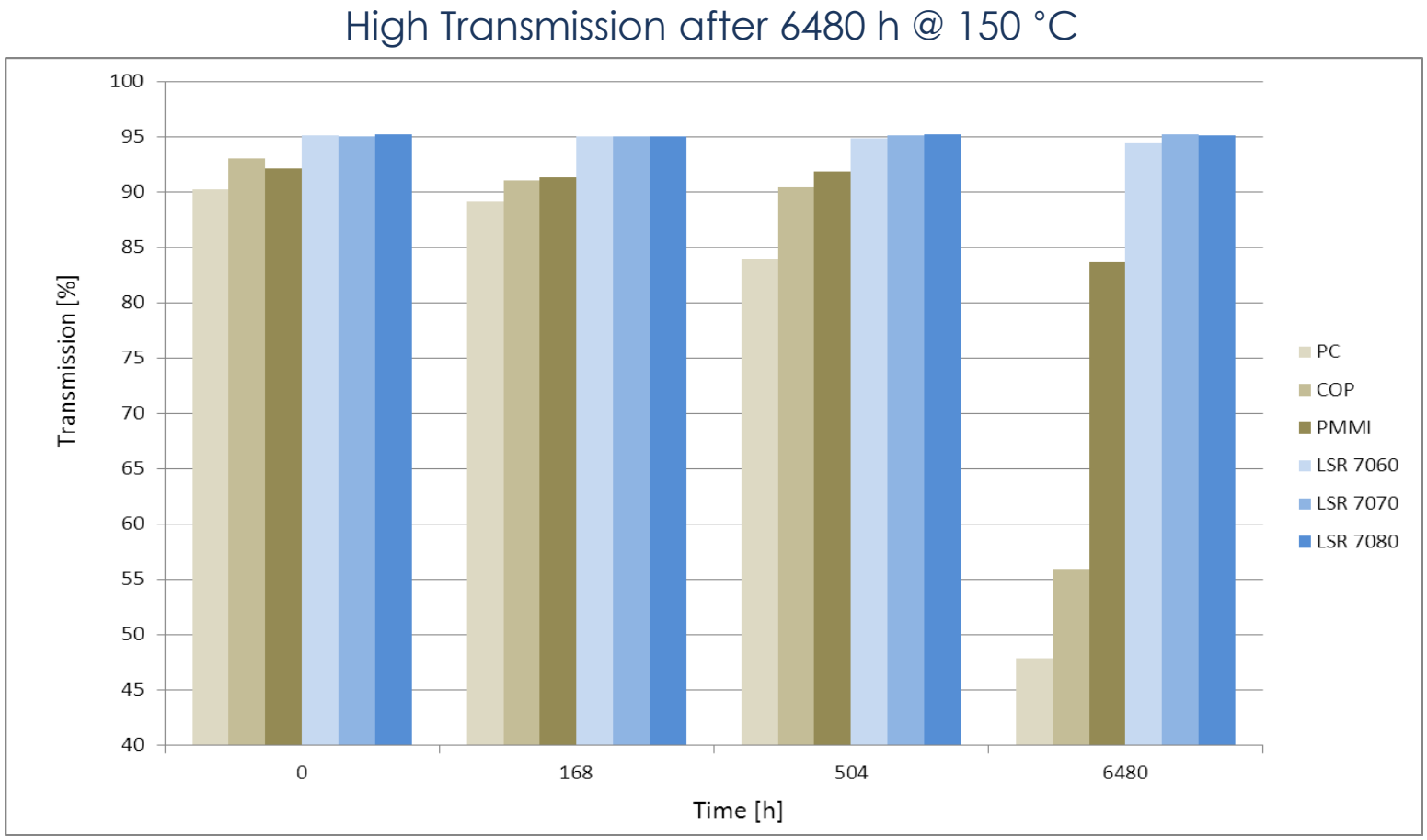
ULTRA CLEAR LIQUID SILICONE RUBBER

Ultra Clear Silopren* LSR7000 Series
Durability

Test method: ASTM D 1003, 2mm
Laborwerte Momentive Performance Materials GmbH, 2009



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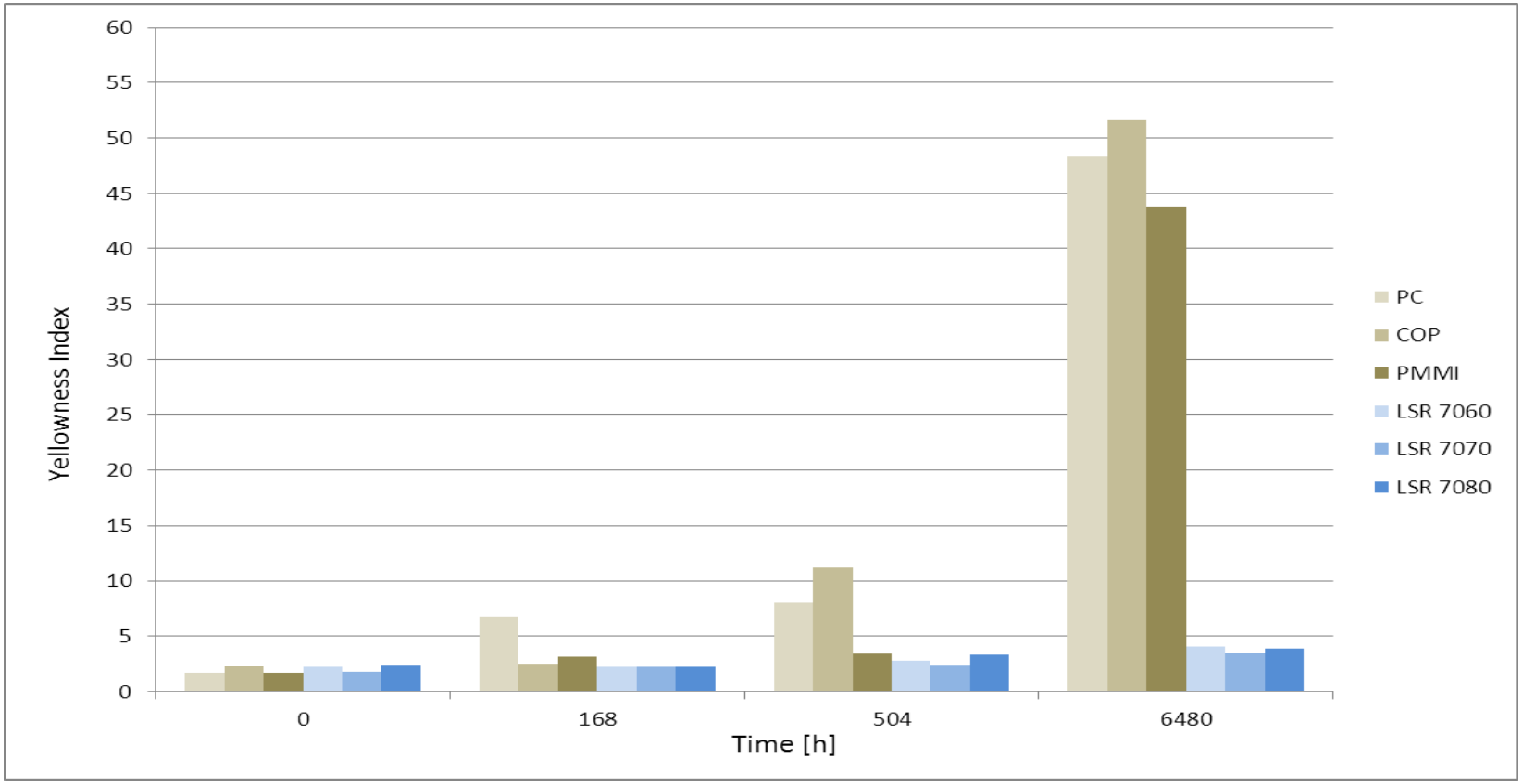
ULTRA CLEAR LIQUID SILICONE RUBBER

Ultra Clear Silopren* LSR7000 Series Durability

Test method: ASTM E313, 2mm
Laborwerte Momentive Performance Materials GmbH, 2009

Low yellowness change after 6480 h @ 150 °C



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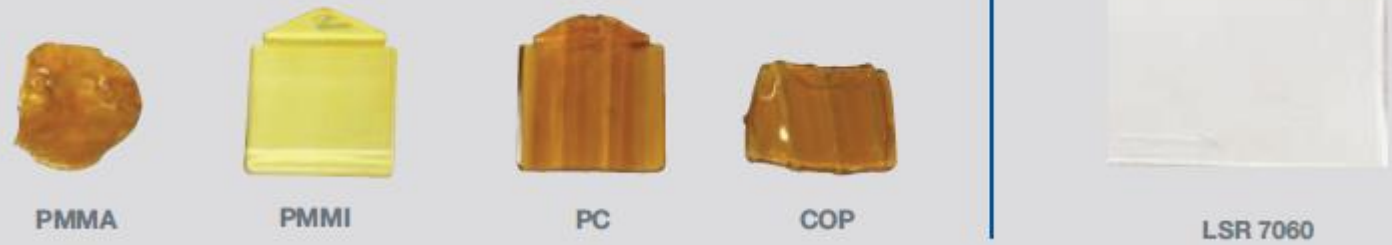
ULTRA CLEAR LIQUID SILICONE RUBBER

Ultra Clear Silopren* LSR7000 Series Durability

Test method: ASTM E313, 2mm
Laborwerte Momentive Performance Materials GmbH, 2009

Test results from Momentive demonstrating yellowing after 6,480 hours at 150 °C on a variety of transparent materials, including the LSR 7000 series.



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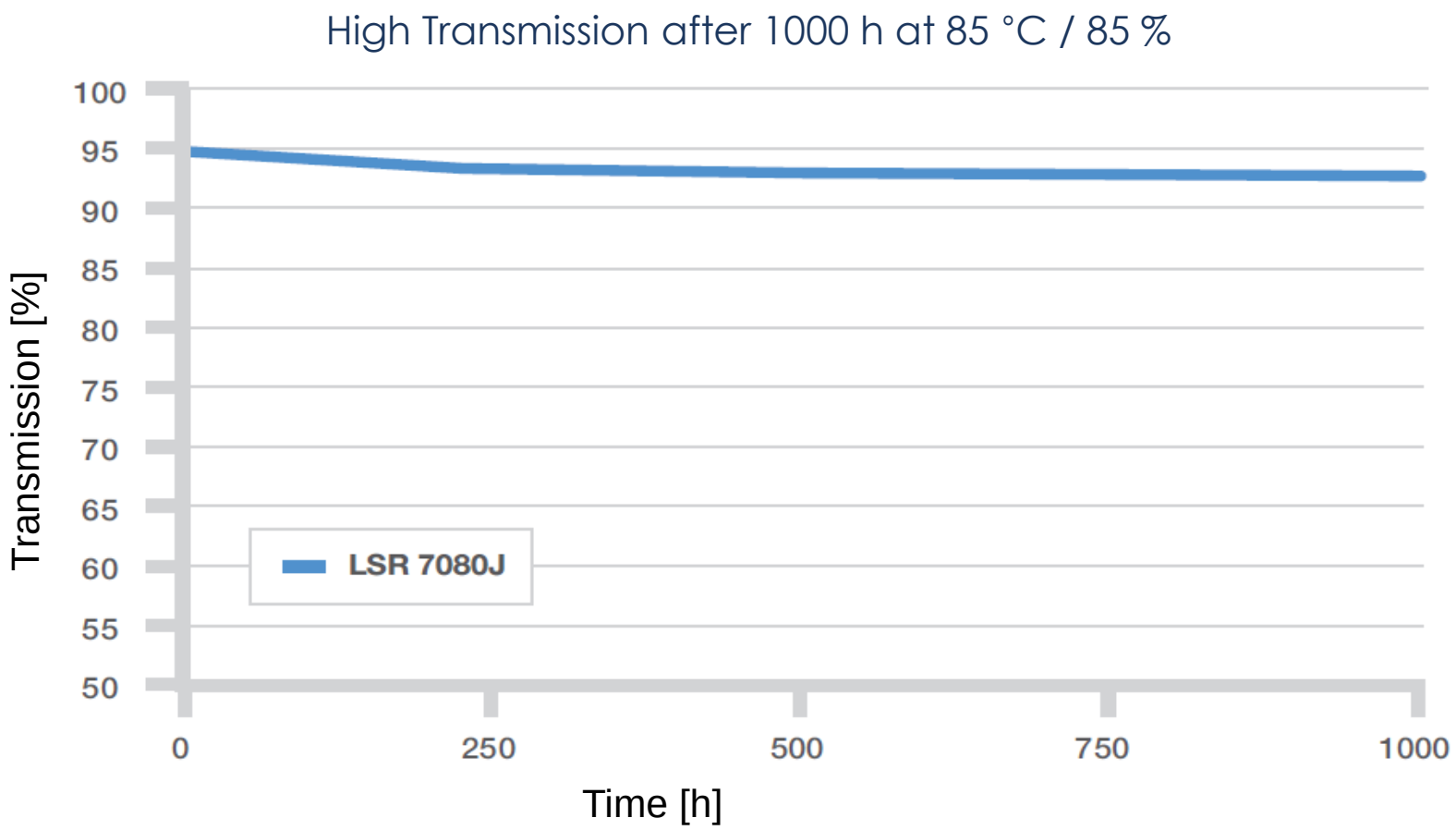
ULTRA CLEAR LIQUID SILICONE RUBBER

Ultra Clear Silopren* LSR7000 Series
Durability



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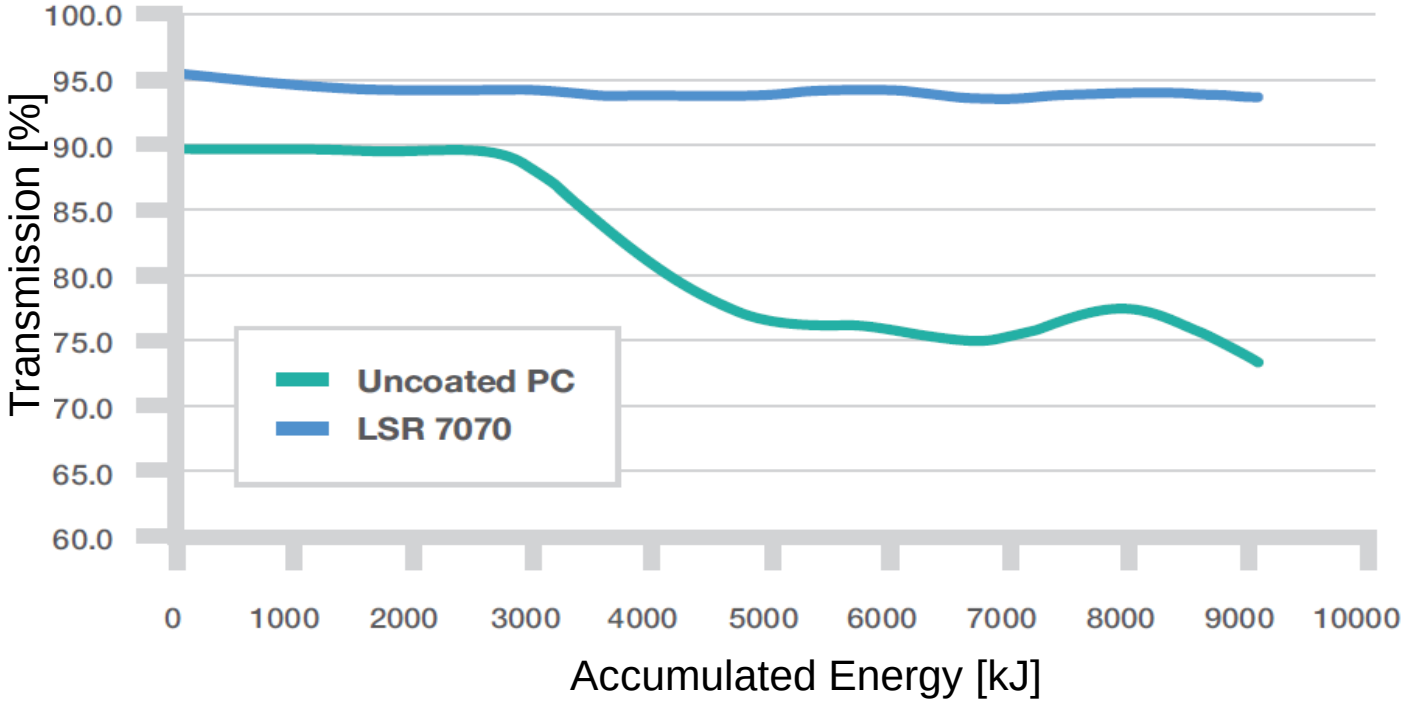
ULTRA CLEAR LIQUID SILICONE RUBBER

Ultra Clear Silopren* LSR7000 Series
Durability

Durability according to SAE J2527 / Automotive

- To retain transmission stability even when the Xeon acceleration test was combined with humidity over time



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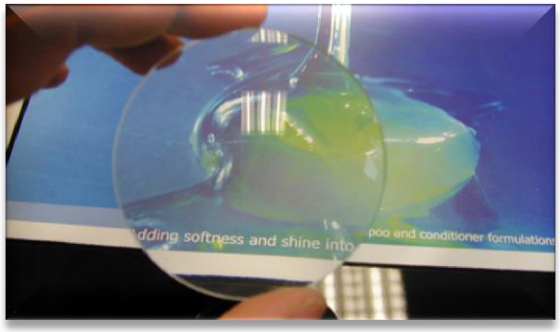
ULTRA CLEAR LIQUID SILICONE RUBBER

Injection Molding – Ultra Clear LSR 7000 Series Process Comparison with Thermoplastics

Design	Size
Diameter	70 mm
Thickness	Max 13 mm
Volume	~ 50ccm



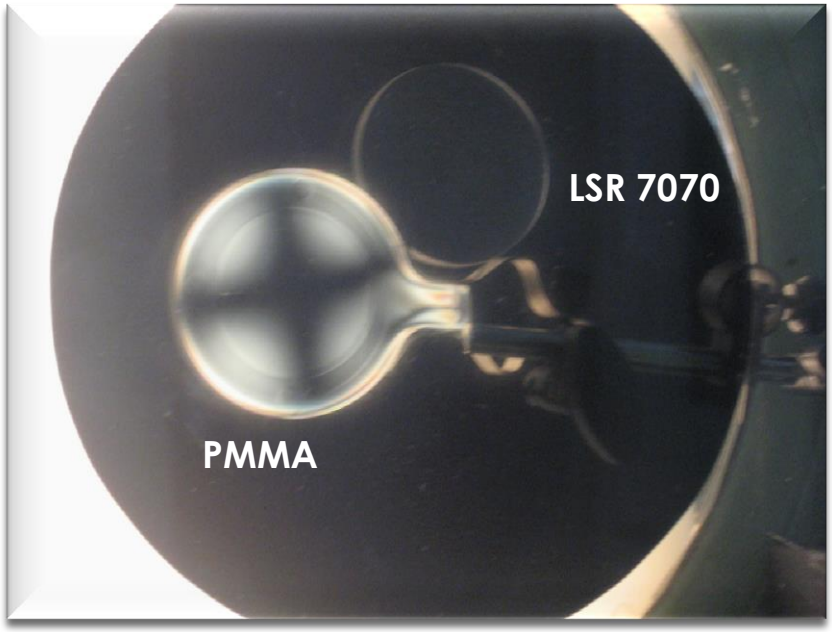
Category			LSR 7000	PMMA	PC	Advantage of LSR 7000
No. of cavity			Excellent	Poor	Poor	High yield per shot
Cycle time	Cooling time	[min]	N/A	12-15	12-15	High productivity
	Curing time		5-6	N/A	N/A	
Gate size			Excellent	Poor	Poor	Easy optic design
Sprue			Excellent	Poor	Poor	Less material waste
Filling pressure		[bar]	25-100	350-550	400-650	Smaller machine possible
Holding pressure		[bar]	150-300	>>600	>>800	
Machine size		[Tons]	60-100	60-150	60-150	

High flow-ability of LSR 7000 Series enables high productivity in mass production and freedom of design

ULTRA CLEAR LIQUID SILICONE RUBBER

Ultra Clear Silopren* LSR7000 Series
Design freedom

Isotropic optical properties



Picture: IKV, Aachen

Lens based on Silopren* LSR 7070

- **Diameter: 70 mm**
- **Thickness: 13 mm**

LSR Injection Molding, Cold Runner and direct gate

- No holding pressure
- No inner tensions
- **Free of birefringence**

Lenses made out of LSR 7070 provide isotropic optical properties

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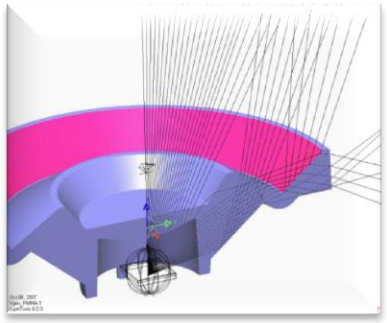
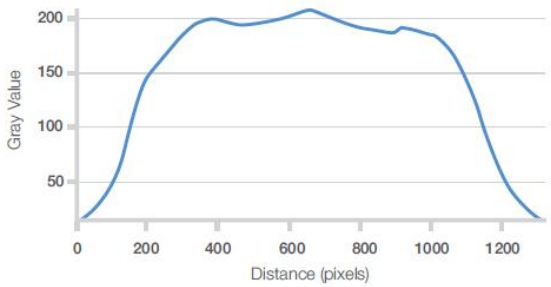
ULTRA CLEAR LIQUID SILICONE RUBBER

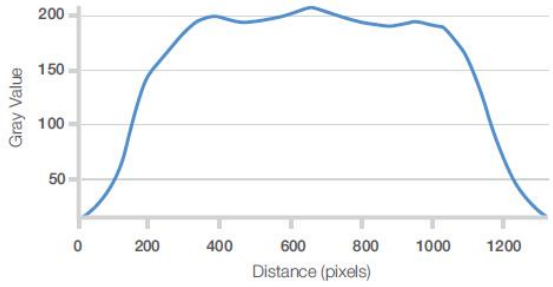
Ultra Clear Silopren* LSR7000 Series Design freedom

- **Optical stability over aging test**
- **Lens + Reflector based on LSR 7070**
  - Wall thickness between 1,7 and 9mm
  - LSR Injection molding, direct gate



Survives 700 hours @ 85 °C / 85 % humidity





Light distribution before test

Light distribution after test

(Source: KIMW, Germany, 2011)

Light Distribution

Precise light projection of the multifunctional lens can be retained even when exposed to heat and humidity.

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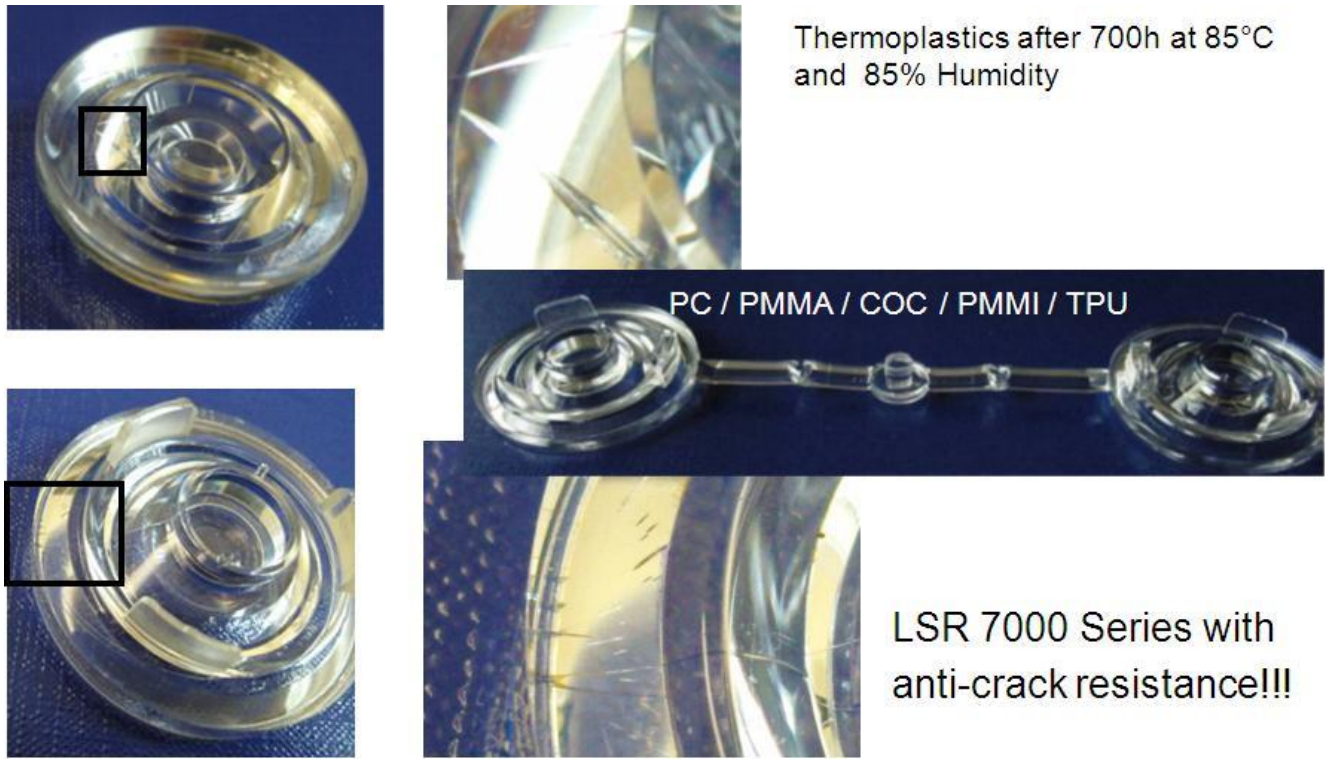
Ultra Clear Silopren* LSR7000 Series
Design freedom

Climate testing of plastics lenses: micro-crack



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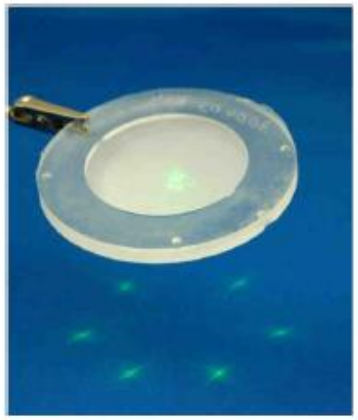
ULTRA CLEAR LIQUID SILICONE RUBBER

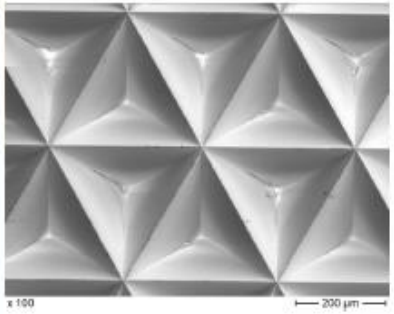
Ultra Clear Silopren* LSR7000 Series
Design freedom

- Optical Design Freedom

LSR process allows implementation of microstructure

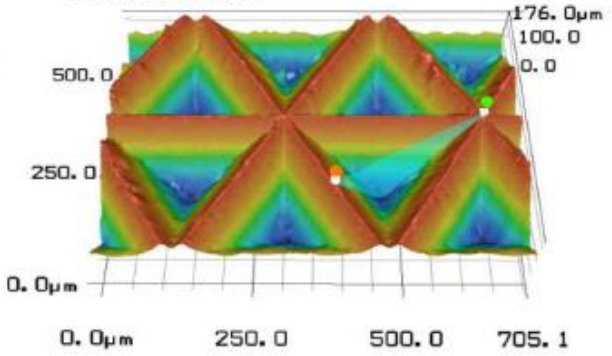
Example: Facet Mirror



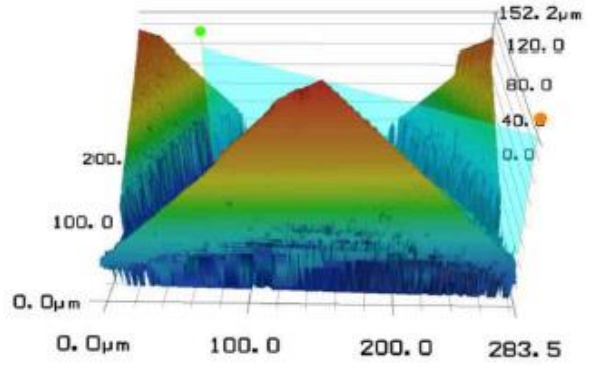


Source: I.K.V., Aachen, Germany

Surface of Mold



Surface of Molded Part



High flowability: easy implementation of micro-structure optical design like Fresnel lenses

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ULTRA CLEAR LIQUID SILICONE RUBBER

Ultra Clear Silopren* LSR7000 Series
Typical Physical Properties

			LSR 7005	LSR 7030	LSR 7060	LSR 7070 FC	LSR 7080 J	LSR 7090
Appearance			Optical Clarity	Optical Clarity	Optical Clarity	Optical Clarity	Optical Clarity	Optical Clarity
Mix ratio			1:1	1:1	1:1	1:1	1:1	1:1
Mix viscosity(23'C)		Pa.s	53	38	46	20	120	42
Cured Properties (Press cure 130'C、15min.、LSR 7090+150'C、1hr post cure)								
Basic								
Density	JIS K6249	g/cm^3	0.98	1.01	1.03	1.05	1.06	1.08
Hardness	JIS K6249	Type A	5	30	60	70	80	90
	-	**Type D**	-	-	18	23	**30**	**42**
Tensile strength	JIS K6249	N/mm^2	0.3	3.5	6.5	8.5	10.0	8.0
Elongation	JIS K6249	%	210	250	340	145	90	50
Tear strength	JIS K6249	N/mm	-	3	11	7	7	8
Optical								
Transmission (2mm)	400nm	%	93	93	93	93	93	93
	700nm	%	94	94	94	94	94	94
Refractive Index	(n_D25)		1.41	1.41	1.41	1.41	1.41	1.42
Haze	D 1003	%	<1	<1	<1	<1	<1	<1
Dispersion		%	50	50	50	49	51	51
Thermal								
CTE		ppm/'C	330	345	290	270	265	250
Linear shrinkage	JIS K6249	%	2.2	2.2	2.1	2.1	2.1	2.0
Others								
Water absorption	D 570	%	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Curing Data	10'@ 110 °C	T60 [min]	0.5	0.4	1.1	1.4	1.4	1.7

A broader portfolio is available to meet specific application requirements

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Next Generation Ultra Clear: LSR7180

Confidential

Comparison LSR 7180 vs. LSR 7080J

		LSR 7080J	*LSR 7180
Mixed Viscosity	[pa*s]	120	25
Press cured 15min at 150 °C			
Basic			
Hardness Shore A		76	75
Tensile stength	MPa	10	12.7
Elongation at break	%	90	100
Tear strength	N/mm	7	7
Optical (6mm)			
Transmission	%, 600nm	94	94
Refractive Index	(n_D25)	1.4	1.4
Yellowness Index	%	1.4	1
Haze	%	1.5	1.5
Thermal			
CTE linear (40-90 °C)		265	265
Linear shrinkage	%	2.1	2.5
Weight loss, 8h@200 °C	%	0.9	0.3
Flammability UL		UL HB	>UL V-1

Typical product data values are averages and should not be used as specifications.
*Data are based on 1st batch of LSR 7180 (lot 150602)

- **Better Flame resistance**

Higher flame resistance, more design freedom with wider range of lens thicknesses / V-1@5mm passed by internal test

- **Less volatile contents**

Less weight loss, lower chance of creating negative impact by volatiles

- **Good mechanical/optical properties**

Good level of hardness, elongation, light transmission and other properties

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ULTRA CLEAR LIQUID SILICONE RUBBER

Ultra Clear Silopren* LSR7000 Series
Durable. Versatile. Optically Clear.

Example: Optical lenses and diffractive optics

- Example - Light Guides
- Flexible, easy-to-assemble
- High transparent, low absorption of light, regular over broad wavelength of light, high efficient light distribution
- Noise dampening in vibration
- High heat resistance
- UV- resistant
- Encapsulation and integration of light source by injection molding
- Easy shaping of microstructures
- LSR injection molding process

Isotropic: minimal to no stress even in complex and micro-structure designs

Optical clarity: uniform and efficient light distribution over a broad range of wavelengths

Elastomeric: flexible and noise/vibration dampening

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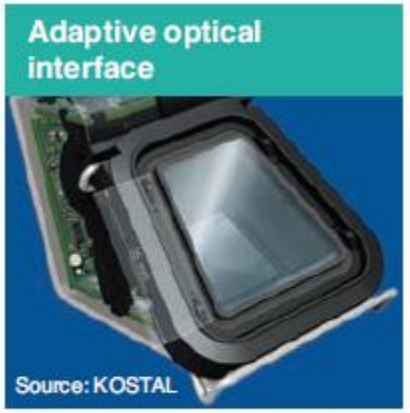
ULTRA CLEAR LIQUID SILICONE RUBBER

Ultra Clear Silopren* LSR7000 Series
Durable. Versatile. Optically Clear.

Example - Coupling Optical Interfaces

- Low Hardness
- Low mechanical stresses in assembling
- Optical clear properties
- Adapts easily to various shapes and surfaces
- Low stress release
- Low module at low temperatures –40°C
- High temperature resistance
- Low yellowing
- No bonding against glass
- High efficiency injection molding processing



Ultra-low modulus: easy to adapt to different shapes, tolerances and surfaces

Picture: KOSTAL

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UV CURE LSR

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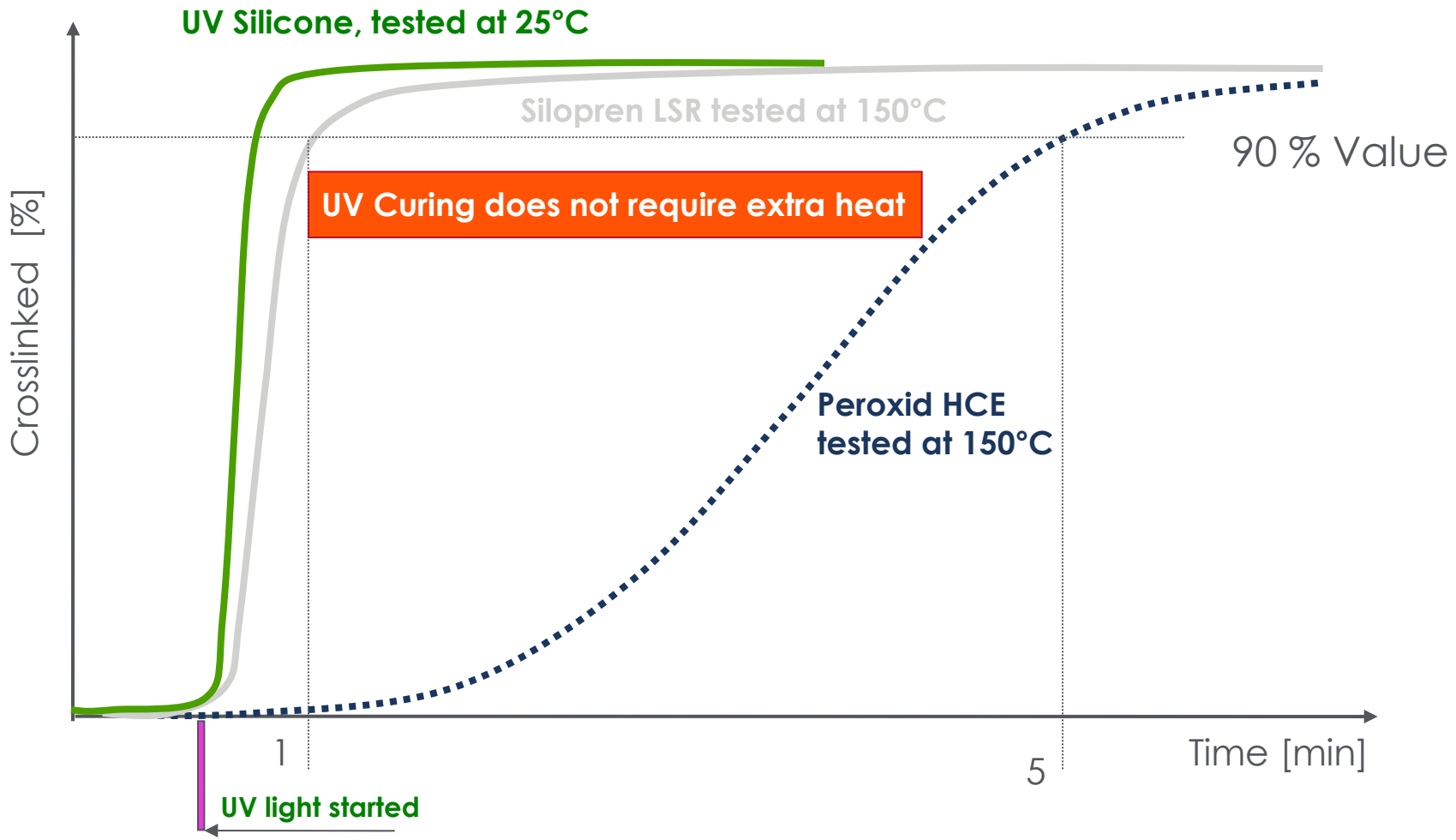
VULCANIZATION: COMPARISON OF THE CROSSLINKING



Curing reaction starts with the activation of the UV sensitive catalyst system

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PRINCIPLES OF COMMAND CURING

UV Cure Technology

- Special, **UV-sensitive catalyst** dedicated for extra UV wavelength range
- Based on conventional silicone polymers
- 2-Component system
  98 parts base component
  2 parts catalyst master batch
- Applied energy ~ 3000 mJ/cm²
- **Curing time seconds to few minutes**

Comparison of curing speed

LSR 2030	UV LSR Electro
20 min @ 110 °C	30 s @ 30 °C

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4 ADVANTAGES OF UV CURING TECHNOLOGY

Command Cure

- fast curing at ambient temperature
- fast curing of thick parts or profiles
- reduction of work steps

→ shorter processing lead times

Clean

- no hazardous chemicals
- addition cure technology
- regulatory compliance

→ less EHS considerations

Green

- lower energy consumption
- no heating of material required
- better temperature control of clean room conditions

→ cost- and ecoconcious production

New

- complex geometries
- low tolerances
- combinations with temperature sensitive materials

→ new fields of application

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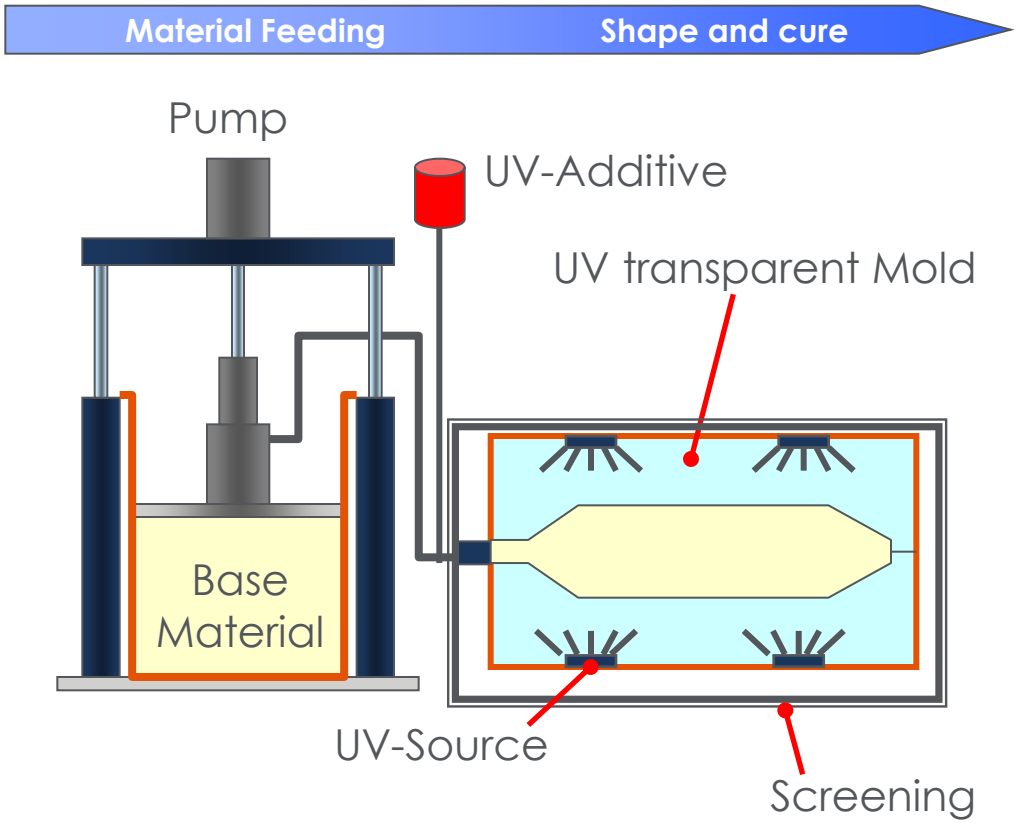
UV CURING OF LIQUID SILICONE RUBBER (LSR)



Process and Material

- Material is pumped into a transparent mold
- Curing initiated with start of UV Light
- Energy dose > 3 J/cm²
- Wavelength 250-400 nm
- Material based on conventional silicone polymers
- Special, UV-sensitive catalyst
- 2-Component system
  100 parts base component
  2 parts catalyst master batch
- Curing time: seconds to few minutes

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UV LIGHT SOURCE: LED TECHNOLOGY

LEDs have a defined wave length

+ No emission of IR Radiation

  => low temperature system

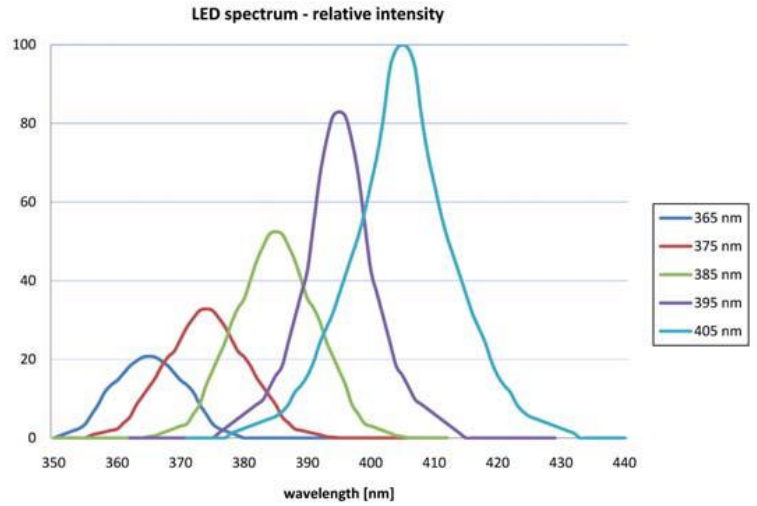
+ Compact size

  => Easy to integrate into the tool

+ Life time of LED > 10.000 hours

  => low maintenance cost

- currently higher $/J



Recommended UV sources for the different processes:

Microwave system	Electrode system	LED
Extrusion/HCR	Molding/LSR, Extrusion/HCR	Molding/LSR

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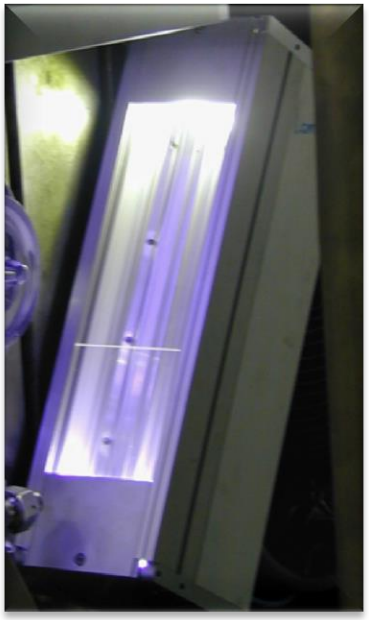
PROCESS OVERVIEW LSR MOLDING WITH UV LSR

MOLDING W/ SILOPREN* UV-CURE LSR

- Standard LSR for injection molding can be cured at 180-200°C for fast cycle times.
- With UV-cure LSR technology, the process has been shown to be more efficient, as filling can be accomplished at ambient temperature.
- There is virtually no risk of generating scorch. When filling is complete, the UV light is activated, travels through UV transparent cavity inserts, and starts the very fast curing reaction.
- Even a large article (up to 100mm cross-section) will cure in several minutes.

UV SOURCE

Different UV-Source technologies established



Main differences are:

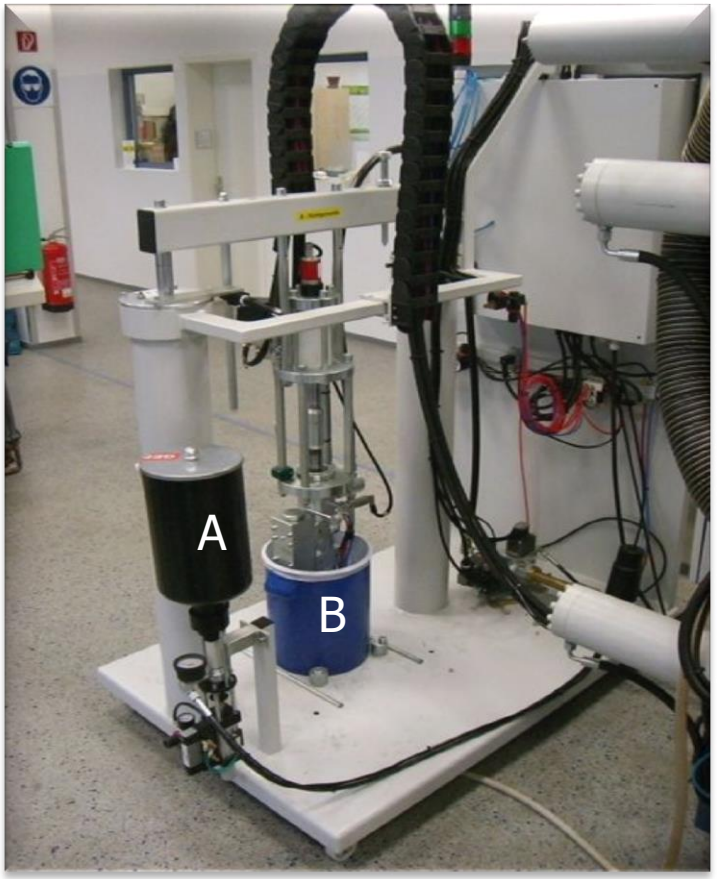
- UV light spectrum ~365 nm
- Power out put >4000 mJ/cm2
- Amount of IR light
- Switch On-Off or Stand By
- Position of generator
  - influence on dimension

- New technology: **LED**

Note: Common UV lamp systems that emit light in wavelengths of UVA (400-315nm) activate the photosensitive catalyst in Momentive's UV-cure silicone rubber. Momentive's technical experts can help you adjust for differences in the UV spectrum, IR emissions, generator position and other factors.

MATERIAL HANDLING / FEEDING SYSTEMS

- **Component (B)** is similar to standard LSR base
- **UV-Catalyst Component (A)** is sensitive to UV light. Handling, storage, mixing and feeding must be under prevention of any UV-light.
- Component (A) is delivered in a sealed container.
- Mixing Base (B) with Catalyst (A) in a ratio of **100:2** and it is recommend to use a metering equipment with UV protected container for Part (A).
- Manual handling for lab scale should be done at **amber light** (UV-free) to prevent any activation



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PROPERTIES OF UV CURING LSRs

	UV Electro 235-2	UV Electro 225-1	UV LSR 2030	UV LSR 2060
Feature	High Voltage 3.5 kV	High Voltage 3.5 kV	Standard low duro	Standard high duro
Base: Viscosity base [Pa*s] at $10s^{-1}$	120	70	500	990
Cat. Batch:Viscosity cat [Pa*s] at $10s^{-1}$	10	10	10	10
Properties of the Vulcanizate				
Hardness [Shore A]	35	25	27	57
Density [g/cm^3]	1,088	1,065	1,094	1,145
Tensile Strength [MPa]	4,6	4,5	5,3	11,0
Elongation at Break [%]	520	580	690	440
Tear [N/mm]	15	9	11	35

Mixing ratio of components Base : Catalyst = 100 : 2.
Laboratory Vulcanization Conditions: exposure to UV light for 2 min at an intensity of 60 mW/cm^2 UV-A

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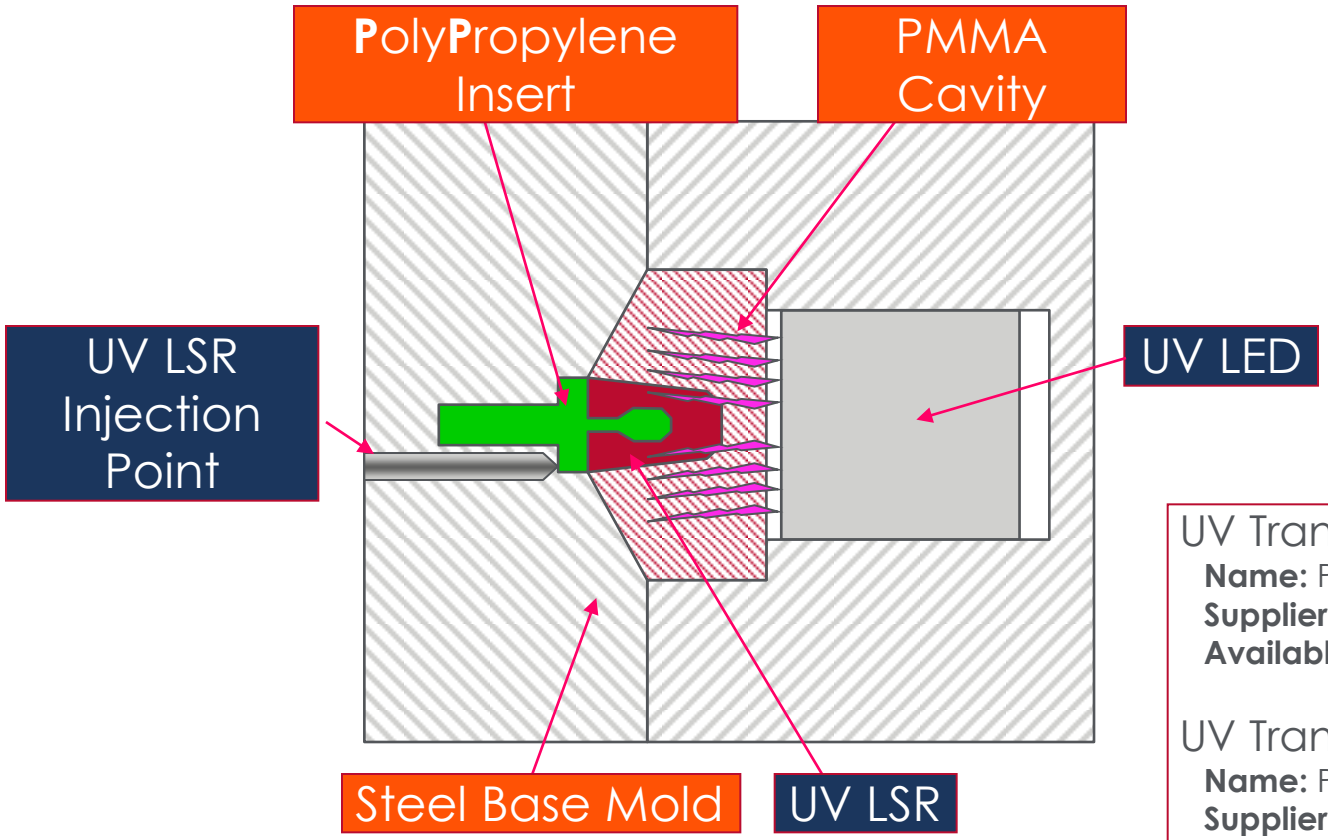
BASIC TOOL CONCEPT

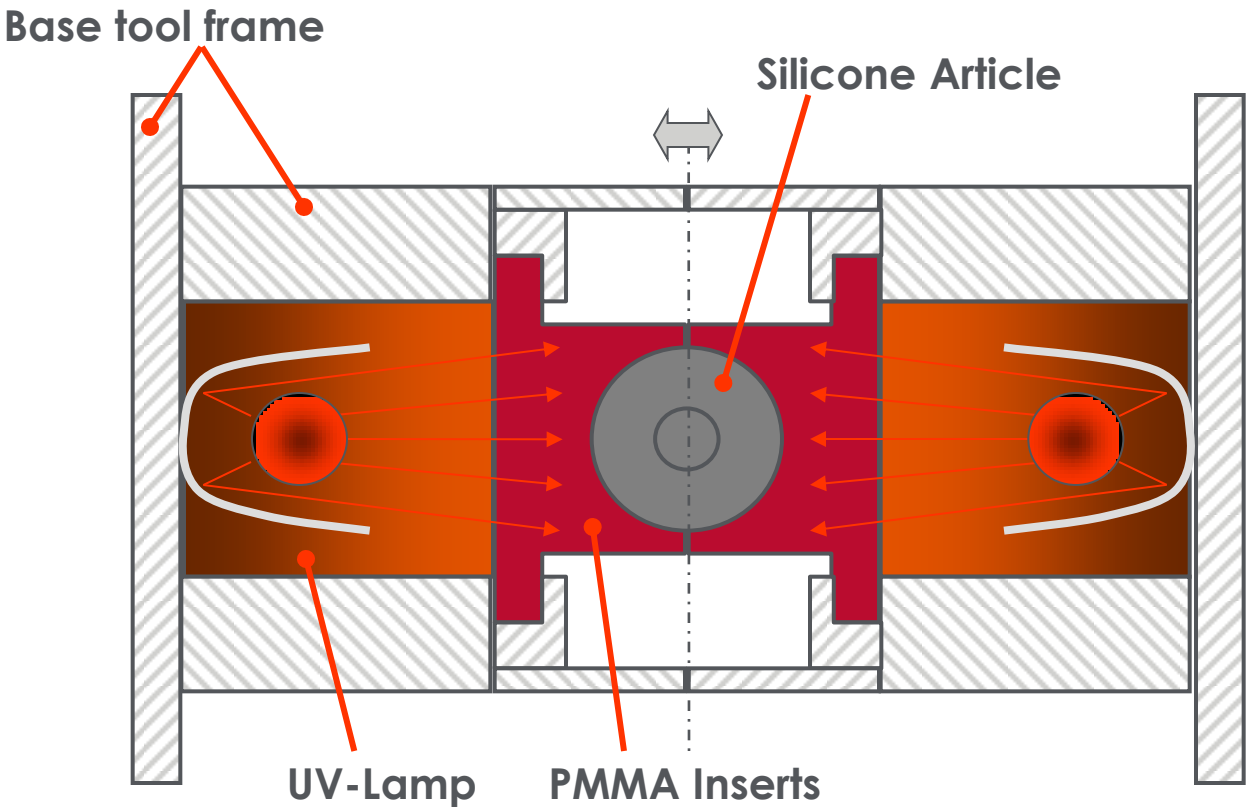
Injection mold for 2C Bottle Closer



UV Transparent PMMA
Name: Plexiglas® GS 0Z18
Supplier: Evonik
Available: blocks up to 100 mm thickness

UV Transparent PMMA
Name: Plexiglas® XT 2458
Supplier: Evonik
Available: Extruded sheets up to 8 mm thickness

HIGH VOLTAGE INSULATOR TOOL CONCEPT EXAMPLE



- Tool is mounted on a standard clamping unit.
- Two UV-lamps are installed behind UV transparent cavity inserts.
- Guidance, UV housing and force load is taken by base tool frame.

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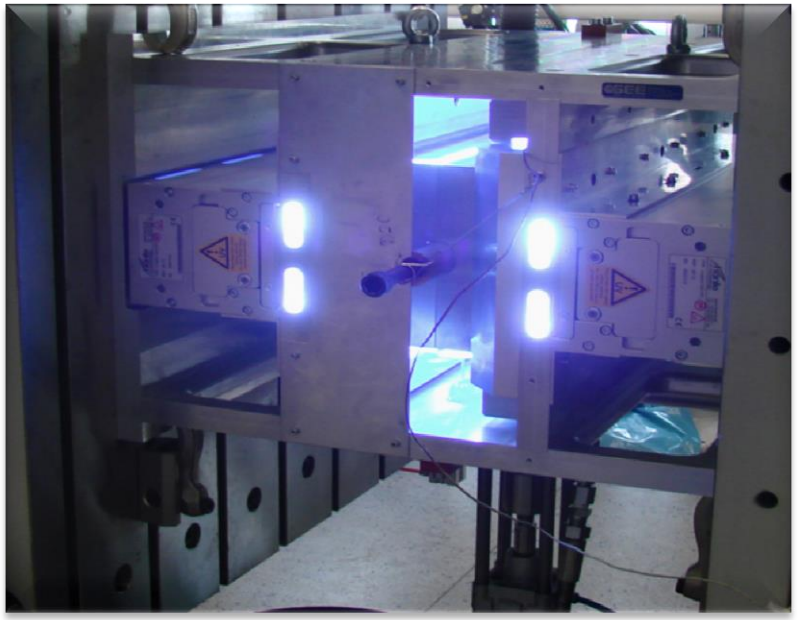
HIGH VOLTAGE INSULATOR TOOL IN PRODUCTION

Open Mold
UV-Lamp in stand by mode



Closed Mold
UV-Lamp at 60% power

RESULTS OF 1ST SHOTS – INSULATOR MOLD

- Filling with 500 cm^3/min
- Power of Lamp at 60 %
- Curing in 90 sec
- Easy Demolding
- Material Temp = 35°C

OVERVIEW OF 2C UV LSR TOOL CONCEPT BOTTLE STOPPER

Tool Section for UV LSR:

- Steel base
- LED position
- Transparent Cavity Inserts
- Temperature 25 – 40°C

Tool Section for Poly Propylene:

- Standards, following basic guide lines for selected plastic material
- Temperature 25 – 35°C

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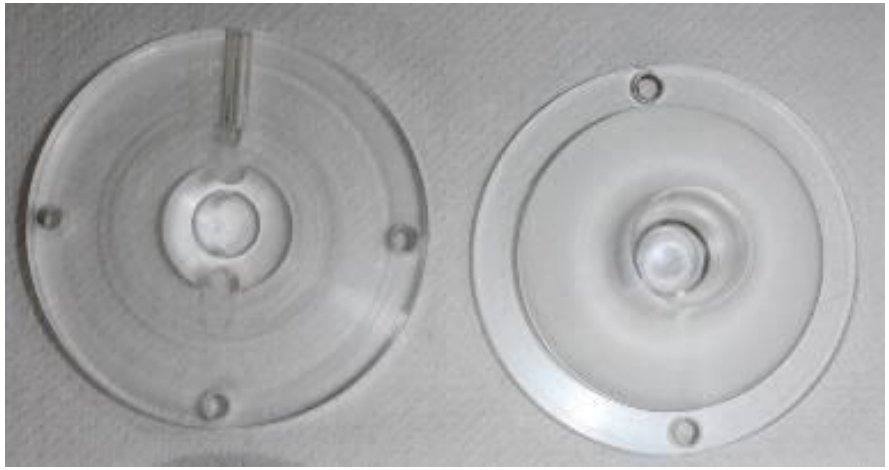
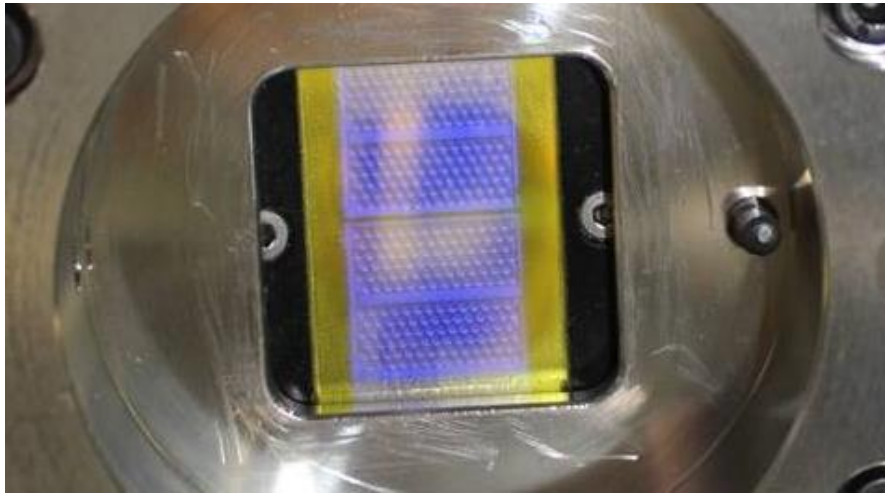
DETAILS OF 2C UV LSR TOOL CONCEPT BOTTLE STOPPER



PMMA Inserts for UV LSR Cavity:

- Selected PMMA, UV transparent
- Finished after typical PMMA recommendations
- Polished surfaces to increase light transmittance
- Calculated with 0,2% shrinkage of LSR



LED System for UV LSR Cavity:

- Selected UV source with UV peak at 365 nm. Energy up to 5000 mW/cm²
- Connected to UV control unit
- Water cooling for internal electronics
- Distance UV LED to PMMA ~ 3 mm

PROCESSING OF UV LSR IN DEMO BOTTLE STOPPER

Equipment:
- Standard LSR machine
- Standard ELMET LSR Feeding System
- Dedicated UV LSR Tool from ELMET

Cycle:
- Injection and cooling of PP
- Insert PP into UV LSR Cavity
- Overmold UV LSR in 2 sec filling time
  Filling Pressure UV LSR 50-100 bar
- Curing UV LSR with UV LED
  in 12 sec at 40°C
- Demolding by handling
- Total Cycle time 55 sec

ADDISIL* UV-CURE SOLID SILICONE RUBBER: PROPERTIES

Raw Material	Addisil UV60ex	
Mooney ML 1+0 25°C	78	
Mooney ML 1+4 25°C	67	
Mechanical Properties	**2 min at 1kW**	**4h at 200°C**
Density, g/cm³	1.17	1.17
Hardness, Shore A	57	64
Tensile Strength, MPa (psi)	9.5 (1376)	11 (1595)
Elongation, %	630	450
Tear Die B, N/mm (ppi)	39 (222)	39 (222)
100% Modulus, MPa (psi)	1.5 (218)	2.4 (348)

UV LSR DATA OVERVIEW

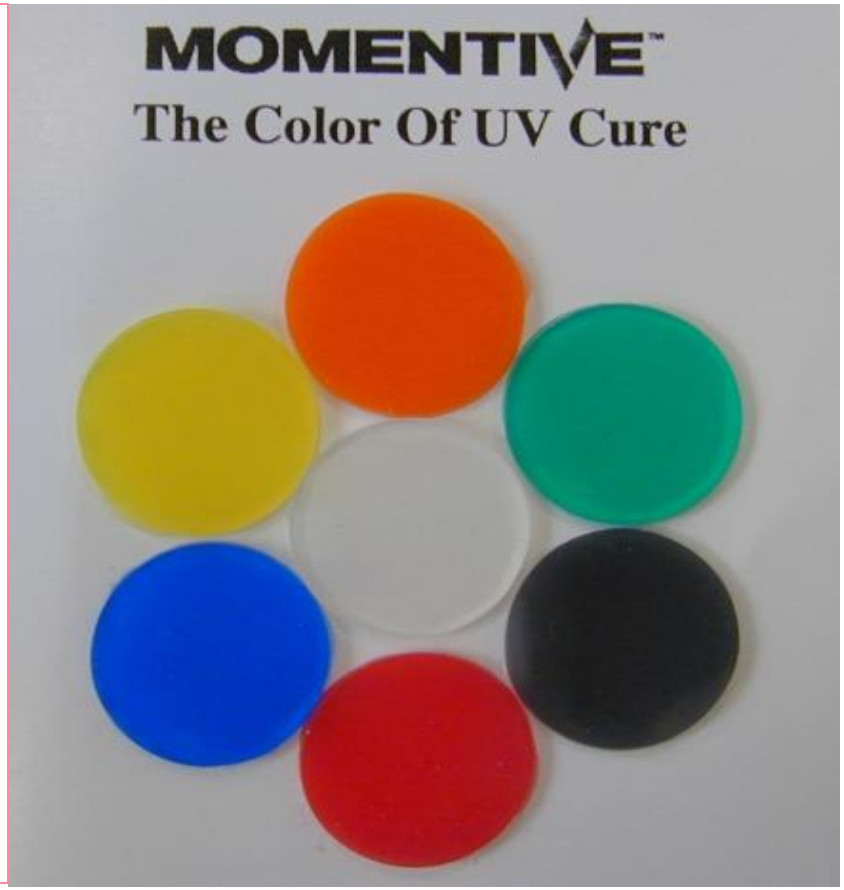
UV LSR Curing time depends on:

1.) UV light, wavelength and intensity

2.) Color Transparency of UV LSR
- Not colored = 12 sec
- translucent red or green = 15 sec

3.) Temperature of LSR
- 35°C = 17 sec
- 45°C = 10 sec

4.) Thickness of article has less impact
- 2 mm = 10 sec
- 5 mm = 10 sec
- 30 mm = 20 - 30 sec
- 50 mm = 30 - 60 sec



BIOCOMPATIBILITY TESTING ON UV ELASTOMERS

Representative samples of ADDISIL UV 60 EX, UV LSR 2030 and 2060 have passed:

- **ISO10993** (Part 5, 6, 10, 11) and **USP Class VI** tests
- Extractraction limits according to **21CF177.2600 (e and f)**

A representative sample of ADDISIL UV 60 EX has passed:

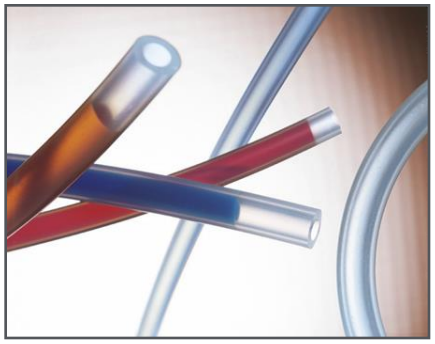
- **European Pharmacopeia 3.1.9** (Silicone Elastomers for Closures and Tubing)

A representative sample of UV LSR 2060 has passed:

- 7 day CIT (Cumulative irritation test)

All UV-curing grades are compositionally compliant with **BfR and 21CF177.2600.**

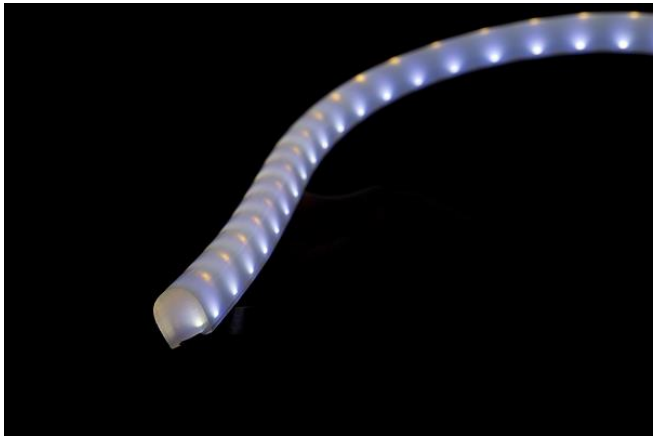
.

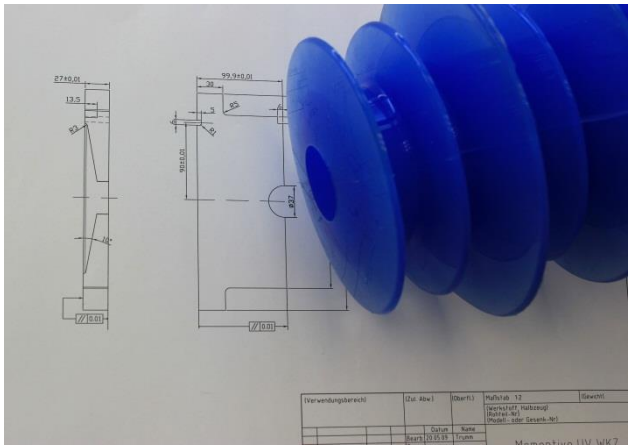


POTENTIAL APPLICATIONS

UV-curing Silicone Elastomers are enabling new combinations:

- 2-component molding of plastics and silicone
  (examples: wine plug, soap holder)
- Encapsulation of temperature-sensitive parts (example: LED strips)
- Coextrusion with thermoplastics: tubes or profiles
- Combination products (drug and medical device) for
  e.g. transdermal patches, cardiology, urology





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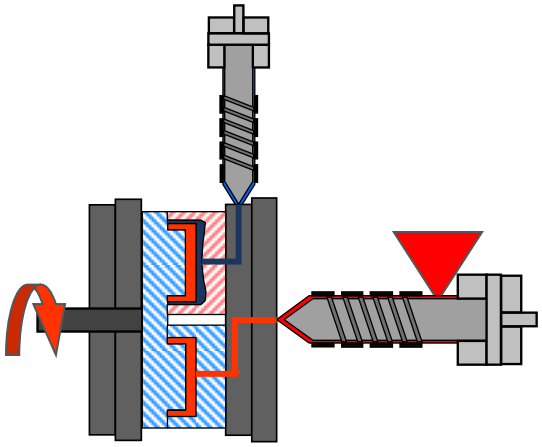
FUTURE OF UV-CURE TECHNOLOGY

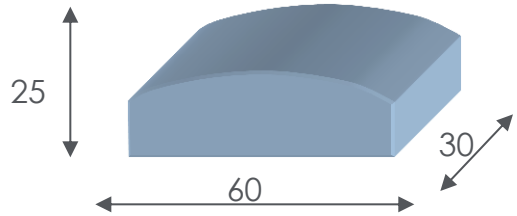


2 – Component Injection Molding

- Overmolding of **Low Temperature Plastics** like **Polycarbonate** and **Polyolefin**
- **Fast cure times** at mold temps < 70°C

Combination of Ultra High Clarity LSR with UV curing Technology for Optical Lenses

- Curing thick cross sections at low temperatures to control thermal expansion of material



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LSR TOPCOAT

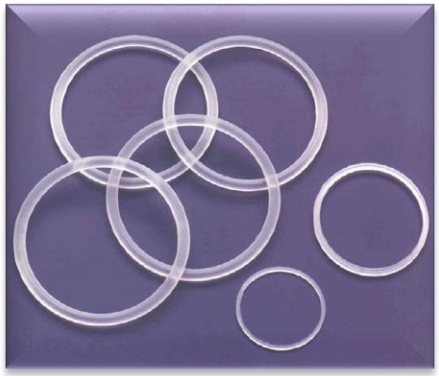
LIQUID SILICONE RUBBER (LSR) TOP COAT

LSR Top Coat is a two-component liquid silicone rubber which forms a colorless matt surface finish via typical coating techniques

Reduced surface friction/surface tackiness

Reduced dust pick up

- Potential biocompatibility
- Reduced surface friction
- Design versatility
- Excellent processability



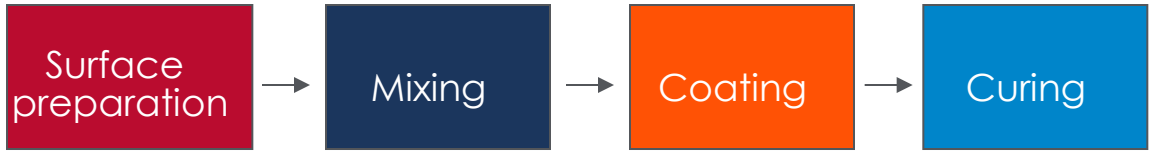
LSR TOP COAT

PROCESSING

How is LSR Top Coat used in applications?

Via typical coating techniques

- **Spray**
- **Dip**
- **Brush**
- **Tumble**



- Excellent for Silicone elastomer substrate (HCE, LSR, RTV)
- Strong bonding (chemical + mechanical) with Silicone substrate
- Adhesion properties can be greatly affected by the substrate surface (topography, residues, etc.)

Brief description of processing parameters

- Surface need to be dust and grease free
- Both A& B need to be stirred well prior to mixing
- Proper mix of component A and B at 1:1 ratio
- Use spray, dip, brush or tumble to coat on the substrate and cure immediately
- Typical curing conditions: 100 - 150°C in air circulated oven for 10-30 minutes
- It is not necessary to coat multiple layers
- Post baking of the top coat may not be necessary

Refer to LSR Top Coat Data Sheet for mixing and curing instructions

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LSR TOP COAT

REGULATORY TESTING

✓	**FDA Indirect food contact (21CFR177.2600)**	
	Extractives	passed
	Composition	Compliant
✓	**Acute Dermal Irritation**	passed
✓	**USP Class VI**	passed

Please note:

- Compliance testing conducted with LSR Top Coat on LIM6040-D1 substrate cured in to ASTM "slabs"
- No post baking on substrate and top coat
- Momentive standard letter stating FDA testing status available upon request

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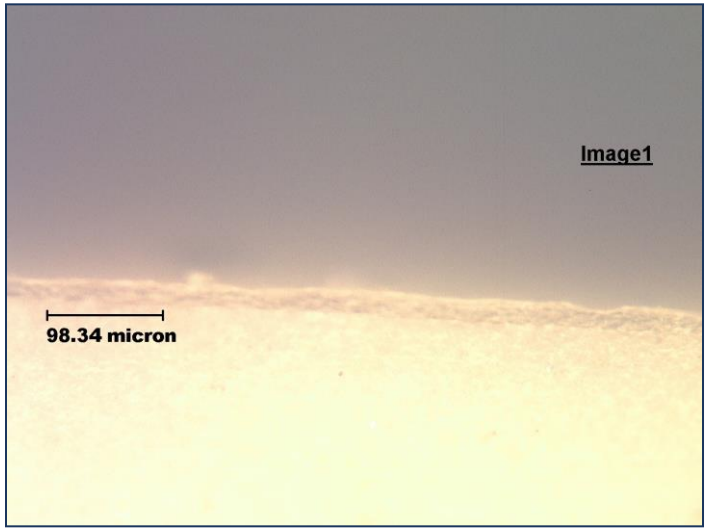
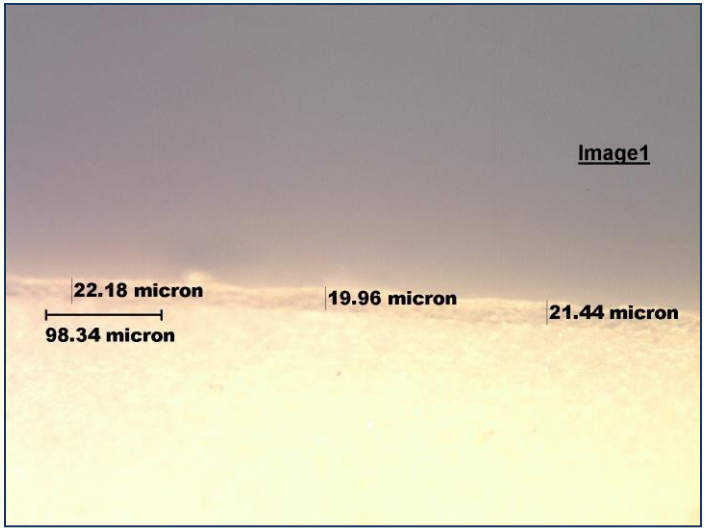
LSR TOP COAT

Processing - Coated Surface





LSR Top Coat forms a uniform thin layer @ ~20 μm

- Single spray on LIM6071 substrate and cured properly
- Cross section of coated substrate shown above
- Image taken via Optical microscopy at 40X magnification

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LSR TOP COAT

Properties - 1. Effect of Coating Methods

Preparation	COF (% reduction)	COF (Magnitude)	Cross-cut Adhesion
Sprayed	43%	0.39	5B - No flaking
Dipped	32%	0.47	4B - Minimal flaking
Sponge brushed	35%	0.40	4B - Minimal flaking

- **All three typical coating methods gave significant reduction of surface friction with excellent adhesion properties**
- **Spray coating appears be the best approach although the most appropriate method may depend upon part design and other process requirements**

  - COF: coefficient of friction
  - COF measured via model SP-101B Slip/Peel tester in accordance with ASTM D-1894
  - Cross-cut adhesion: Cross hatch test for adhesion property measurement; 5B-0B refers to scale of adhesion: 5B being best adhesion and 0B being no adhesion
  - Substrate used in this study: LIM6071

LSR TOP COAT

Properties - 2. Effect of Numbers of Coating

Preparation	COF (% Reduction)	COF (Magnitude)	Cross-cut Adhesion
Single Spray	56%	0.31	5B - No flaking
Double Spray	56%	0.32	5B - No flaking
Triple Spray	52%	0.33	5B - No flaking

- **Optimum results can be obtained by single spray**
- **More layers of coating does not necessary provide better adhesion and reduction of surface friction**

  - COF: coefficient of friction
  - COF measured via model SP-101B Slip/Peel tester in accordance with ASTM D-1894
  - Cross-cut adhesion: Cross hatch test for adhesion property measurement; 5B-0B refers to scale of adhesion: 5B being best adhesion and 0B being no adhesion
  - Substrate used in this study: LIM6071

LSR TOP COAT

Properties - 3. Effect of Curing Conditions

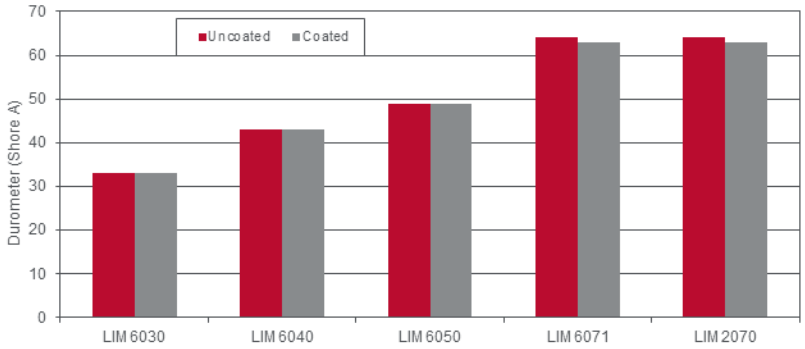
Preparation	COF (% Reduction)	COF (Magnitude)	Cross-cut Adhesion
Sprayed (10min@100C)	52%	0.32	5B - No flaking
Sprayed (30min@100C)	50%	0.34	5B - No flaking
Sprayed (20min@140C)	55%	0.33	5B - No flaking
Sprayed (10min@180C)	50%	0.36	5B - No flaking
Sprayed (30min@180C)	41%	0.37	5B - No flaking

- **Processability of LSR Top Coat : excellent adhesion and reduction of surface friction can be achieved within wide processing window**
  - COF: coefficient of friction
  - COF measured via model SP-101B Slip/Peel tester in accordance with ASTM D-1894
  - Cross-cut adhesion: Cross hatch test for adhesion property measurement; 5B-0B refers to scale of adhesion: 5B being best adhesion and 0B being no adhesion
  - Substrate used in this study: LIM6071

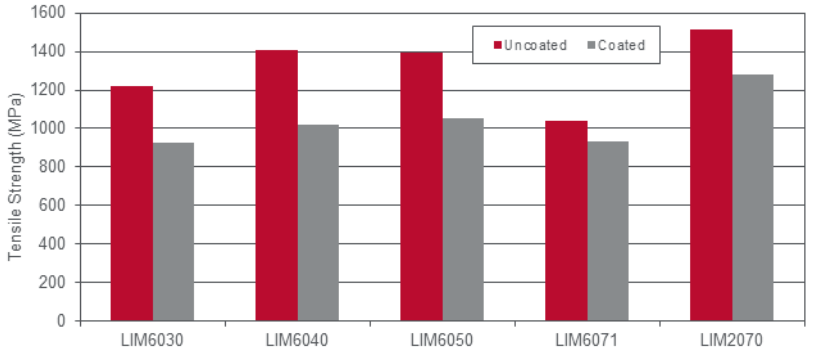
LSR TOP COAT

Properties - 4. Effect of Coating on Substrate Properties

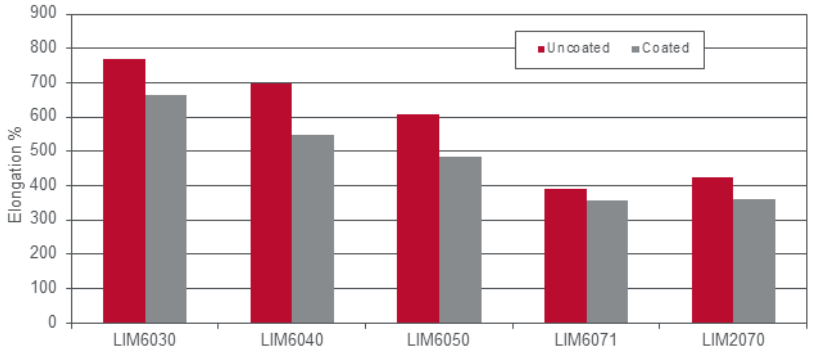
Durometer



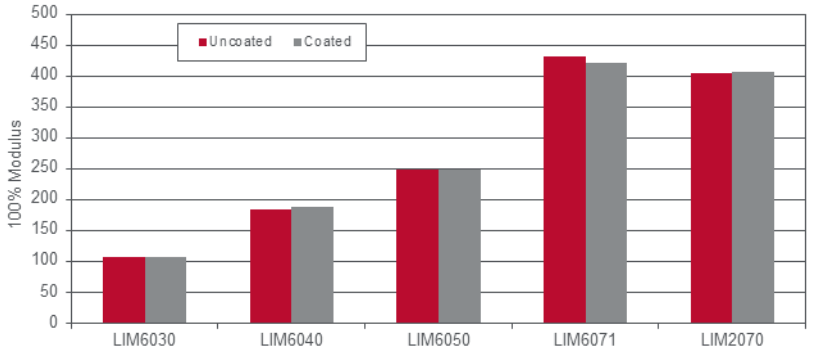
Tensile Strength



Elongation



100% Modulus



Across wide hardness range, LSR Top Coat has minor effect on tensile and elongation; almost no effect on hardness and 100% modulus

- *All samples post baked 30 minutes @350F*
- *All substrates are coated with single spray*

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LSR TOP COAT

Properties - 5. Abrasion Resistance

Test protocol:	GM9909
Abrasive substance:	Glass
Loading:	1 kg
Result:	8000 cycles (no break through)
Film thickness:	~15 microns

- **LSR Top Coat displays good abrasion resistance**
  - Abrasion resistance test GM9909 (General Motor automotive specification) :
  - Substrate used is LIM 6071
  - For reference, a typical weather strip coating last 20.000+ cycles in this testing setup

LSR TOP COAT

Properties - 6. Chemical Resistance

Chemicals	Rating
Windex	satisfactory
Fantastik	satisfactory
Formula 409	satisfactory
Armor all cleaner	satisfactory
GM windshield wash	satisfactory
GM chrome cleaner	satisfactory

- **LSR Top Coat displays good chemical resistance against many common chemical substances**
  - Chemical Resistance Test GMN10059 (General Motor automotive specification) : rating of satisfactory requires no staining, discoloration, or softening of the coating
  - Substrate used is LIM 6071

LSR TOP COAT

PRODUCT COMPARISON

Comparative Materials	Comparison
Lubricating Fluids	▪ Applied on substrate via spray, dip or brush ▪ Not suitable for certain healthcare applications due to contamination by fluids ▪ Typically not biocompatible
Parylene	▪ Applied on surface via vapor deposition coating ▪ Expensive equipment & time consuming process ▪ Poor elongation property of coating layer ▪ Biocompatibility/USP VI compliance
LSR Top Coat	▪ Applied on substrate via spray, dip or brush ▪ Excellent for silicone elastomer substrate ▪ Potential biocompatibility/USP VI compliance† ▪ Flexible coating layer (good elongation)

† *One time test passed USP Class VI over LIM6040 substrate*

LSR TOP COAT

TYPICAL DATA

Properties	Typical Data
Color	Colorless matt finish
Viscosity @25°C	~1600 cps
Specific gravity	1.03 g/cc
Pot life of 1:1 ratio mixture @25°C*	~ 4-6 hours
Refractive Index	1.41

- The pot life of the mixture can be increased to 2-3 days if the mixture is kept well below room temperature
- Apply the coating immediately after mixing to avoid viscosity build up and ingredient settlement over time

SILOPREN MARTIX

THE NEED FOR FIBER REINFORCED LSR

- **Driver** -increasing demand for high strength and high stiffness rubber across a range of many industries, and need for higher performing elastomers in wearable products for consumer and medical applications.

Typical materials used for these applications:

- **Natural rubber based products** have been increasingly replaced due to potential skin irritation / allergy issues.
- **TPUs (thermoplastic polyurethanes),** have the disadvantage that they are, as a rule, harder, and they also have poorer UV resistance compared to alternatives.
- **Silicone elastomers** for those applications exhibit good tissue and skin compatibility, comfort and excellent weather ability.

Silicone performance vs. competitive materials:

- Poorer mechanical properties in comparison to TPUs and natural rubber.
- Low modulus combined with the low tear propagation resistance of silicone rubber.
- In particular, it demonstrates weakness to tensile strength/torsion tests, which are typical for watchbands

SILOPREN MATRIX FIBER REINFORCED LSR OVERVIEW

- Combination of LSR with textile fibers
- Features
  - Chemical bonding matrix to fibers
  - Typical LSR processing and cycle times
  - Increase of the stiffness up to an elongation of 40% (see figure 1)
  - Higher modulus resulting in a longer life in the tensile strength / torsion test.
  - Potential for part weight reduction (>50%) in applications such as mobile phone cases and exhaust hangers via lower wall thickness

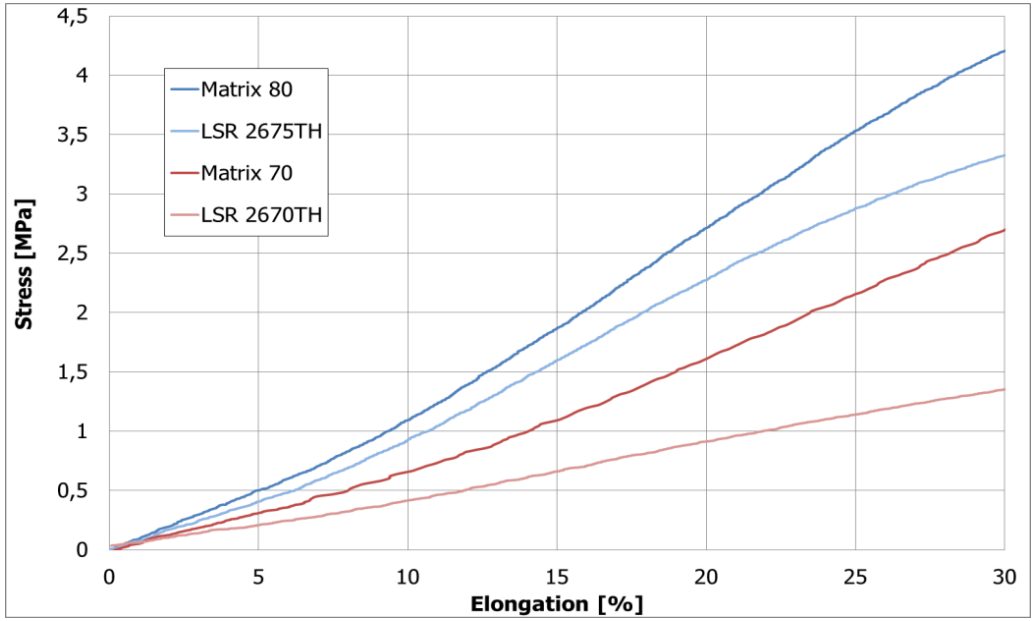

FIGURE 1: COMPARISON OF THE MODULUS OF FIBER-REINFORCED LSRS WITH STANDARD SILICONE ELASTOMERS OF THE SAME HARDNESS

SILOPREN MATRIX 70 and 80 POTENTIAL APPLICATIONS

- Membranes
- Watch Bands
- Wearable Devices
- Pressure Hoses
- Exhaust Hangers

MATRIX 70 AND MATRIX 80 LSR

Typical Physical Properties

Typical properties of the vulcanizate: Mixing ratio of components A : B = 1 : 1.			Matrix 70 LSR Post cured 4 h 200 °C	Matrix 80 LSR Post cured 4 h 200 °C
Density	DIN 53 479 A	g/cm³	1.136	1.145
Shore A hardness	DIN 53 505	–	70	80
Tensile strength	DIN 53 504 S2	N/mm²	7.8	6.6
Elongation at break	DIN 53 504 S2	%	252	28
Tear strength	ASTM D 624 die B	N/mm	44.3	17.2
25% Modulus	DIN 53 504 S2	N/mm²	3.8	6.6
50% Modulus	DIN 53 504 S2	N/mm²	4.4	–

Typical properties of the uncured rubber:					
		Silopren Matrix 70 LSR		Silopren Matrix 80 LSR	
		A Component	B Component	A Component	B Component
Appearance		translucent	translucent	translucent	translucent
Viscosity in Pa·s g =10^{s-1} @ 20 °C	DIN 53019-1				
The pot-life of the mixture of the two components (closed vessel) at 20 °C is usually three days. Increased temperatures reduce the pot-life.					

Typical properties are average data and are not to be used as or to develop specifications.

ANTIMICROBIAL ELASTOMERS

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STATSIL* ANTIMICROBIAL SILICONE ELASTOMERS

http://www.momentive.com/statsil/

STATSIL* ANTIMICROBIAL SILICONE ELASTOMERS

- Liquid Silicone Custom Formulations for Molded Medical Devices
  - Silver antimicrobial additives
  - Optimized cure rheology for high productivity
  - Full range of durometers to meet design specifications
  - Examples…Needleless IV valves, catheter fittings

- High Consistency Silicone Rubber for Extruded Tubing and Profiles
  - Silver antimicrobial additives
  - Compatible with both platinum and peroxide cured silicone elastomers
  - Full range of durometers to meet design specifications
  - Examples…wound drainage tubing, catheters, endotracheal tubes

Key Features

Restricts bacterial growth
Can minimize staining, odor, fouling, degredation of silicone due to microbial growth
Effective at ppm Ag+ levels
Biocompatible and FDA compliant

Momentive antimicrobial elastomers are not registered under state or national pesticide laws; these elastomers should be used solely for use in preventing the growth of microbes in or on the human body, and should not be used to provide general public health benefits.

Momentive elastomers are manufactured and sold for industrial use. Prior to use for any application other than an industrial use, the user has the sole responsibility of determining the suitability of these products for any such application. Momentive Silicone rubber products are not designed or intended for permanent implantation into the human body.

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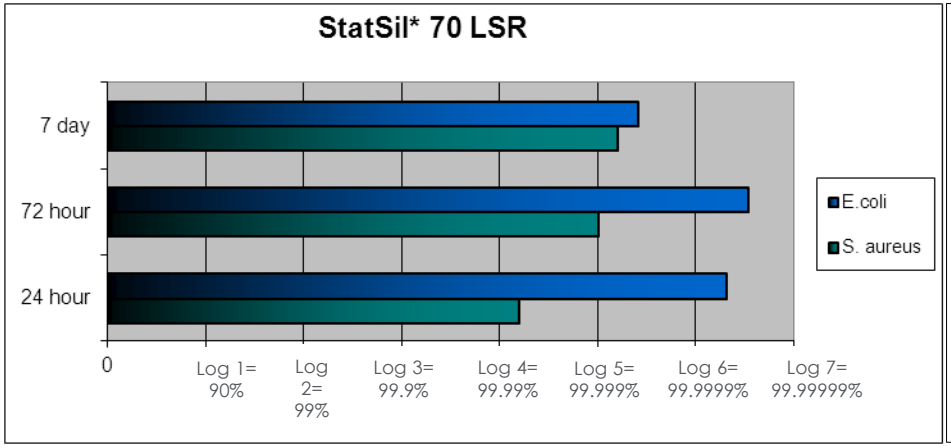
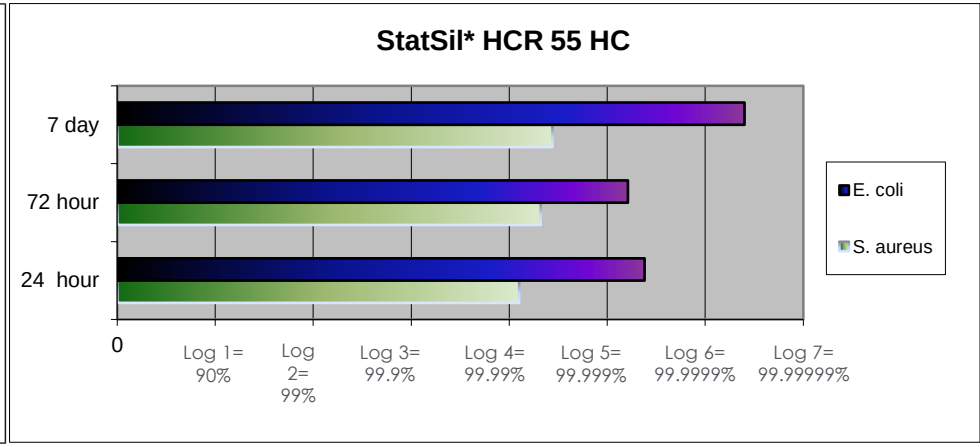
7 DAY MICROBIAL CHALLENGE

Log Reduction (% Efficacy) vs. Control





Test Method	AATCC Method 100, Film Contact Method
Culture Medium	Soybean Casein Digest Broth
Sample Size	48 mm disc
Neutralizer	Letheen Broth

Innoculum Concentration (CFU /0.4mL0	S. aureus ATCC 6538	E. coli ATCC 8739
initial	2.0 x 10^5	1.7 x 10^5
6 day	1.5 x 10^5	2.4 x 10^5

Test Method	AATCC Method 100, Film Contact Method
Culture Medium	Soybean Casein Digest Broth
Sample Size	48 mm disc
Neutralizer	Letheen Broth

Innoculum Concentration (CFU /0.4 mL)	S. aureus ATCC 6538	E. coli ATCC 8739
initial	1.9 x 10^5	2.4x 10^5
6 day	2.5 x 10^5	2.2 x 10^5

*this data has been generated for laboratory screening purposes and solely to show the efficacy of the antimicrobial additive when incorporated into silicone elastomers vs. a an untreated sample with no antimicrobial additive. Momentive Performance Materials does not make any public health claims with respect to this product.

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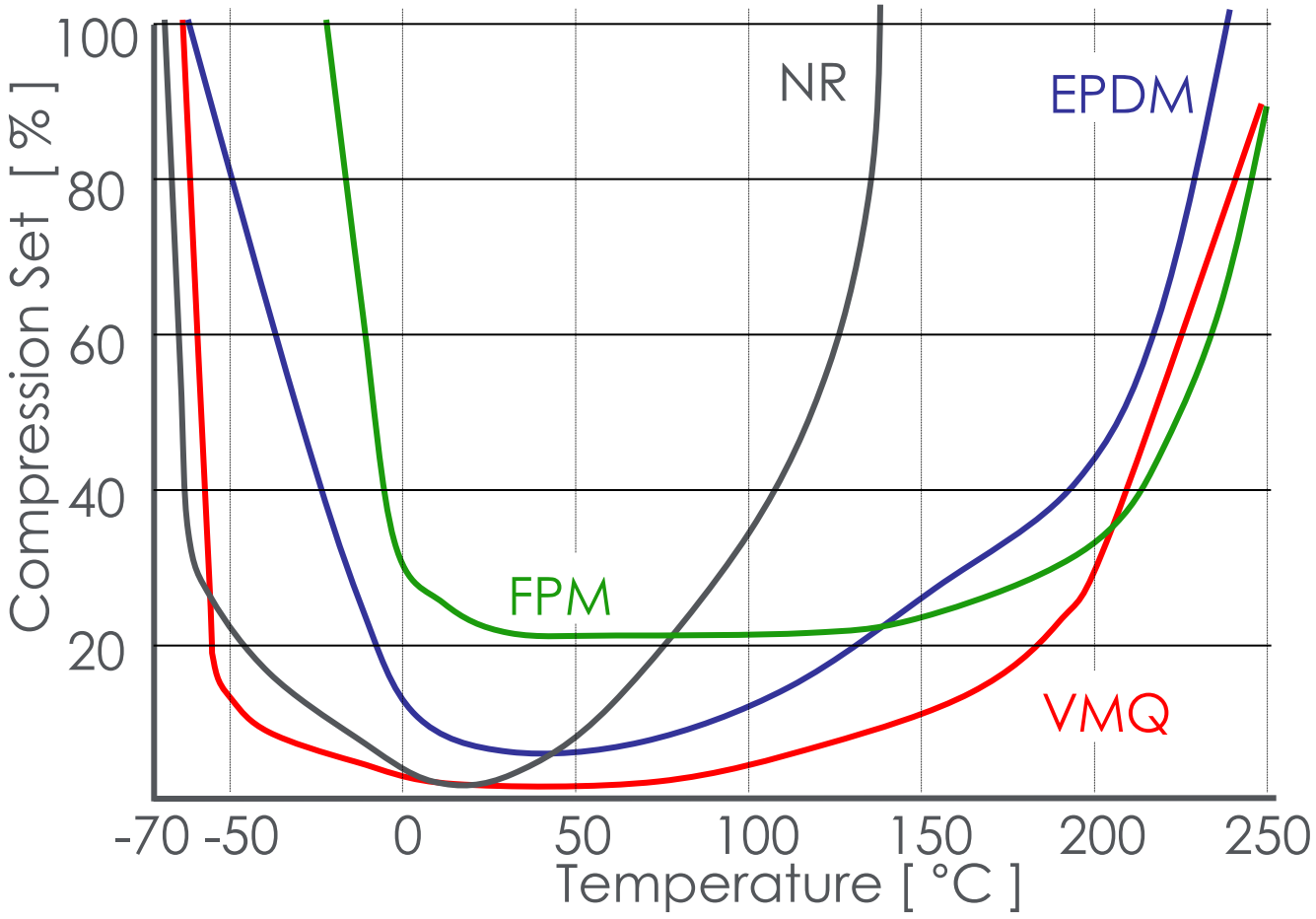
APPENDIX

TYPICAL COMPRESSION SET OF VARIOUS RUBBERS



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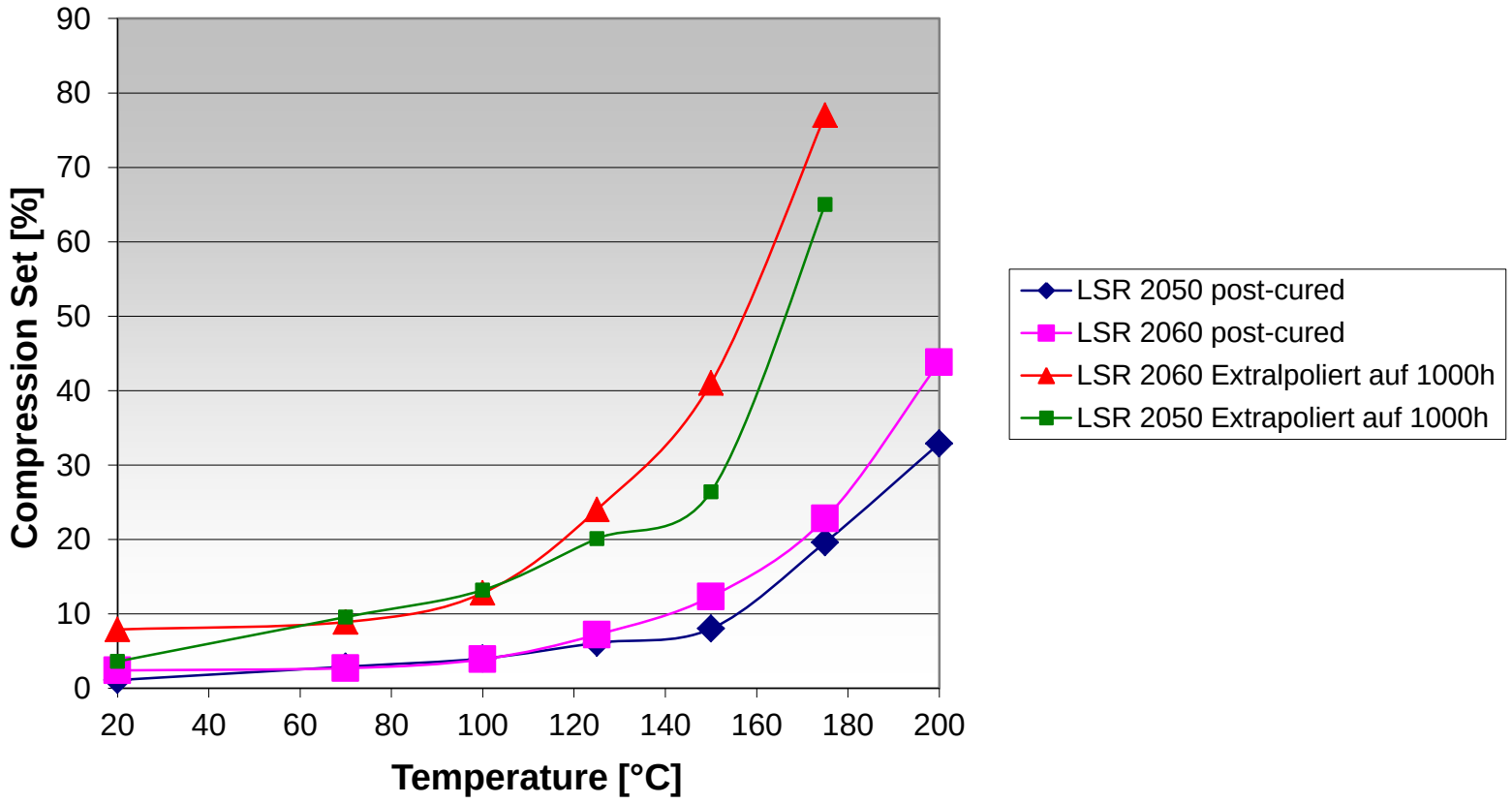
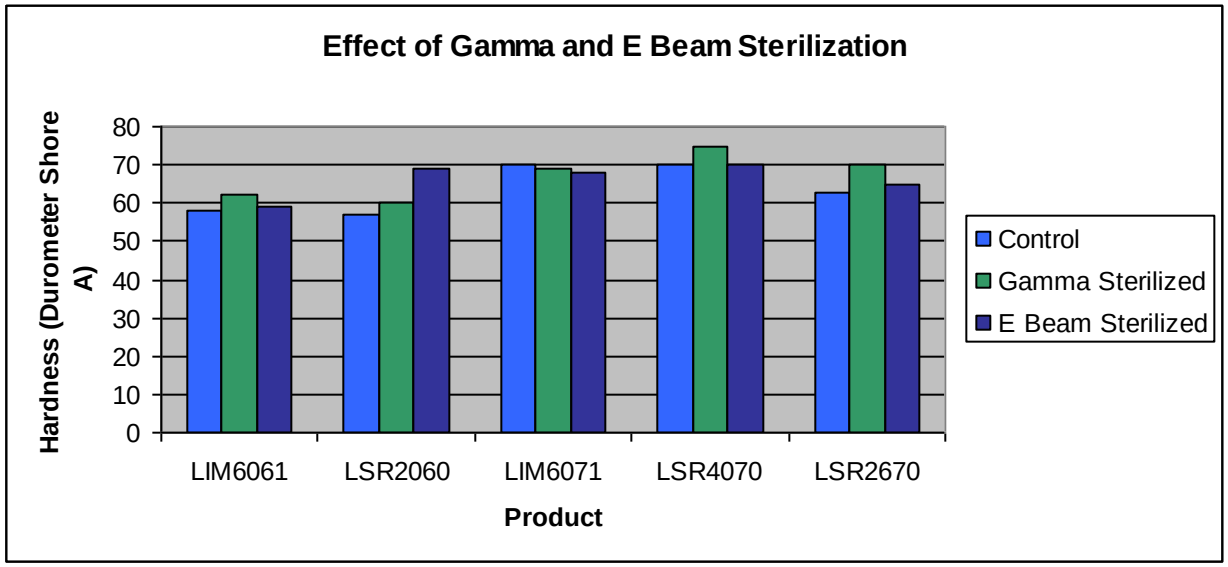
COMPRESSION SET OF LSR

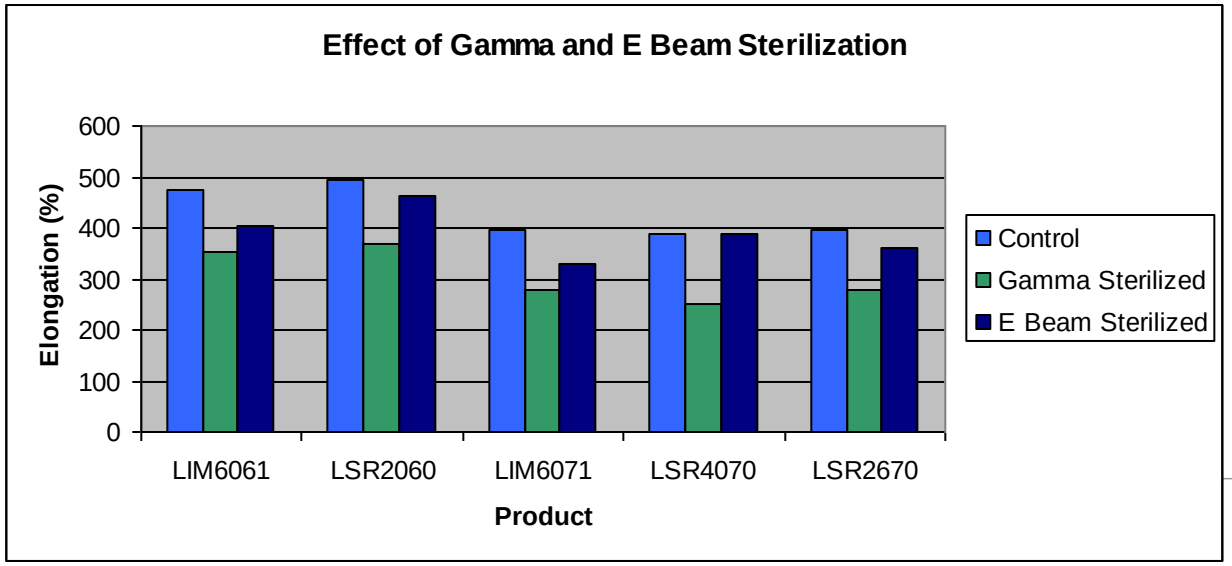
Compression set of Silopren LSR 2050 and LSR 2060 at diverse temperatures



STERILIZATION INFORMATION

EFFECT OF STERILIZATION ON HARDNESS AND ELONGATION





Sterilized at 45-50 kGy

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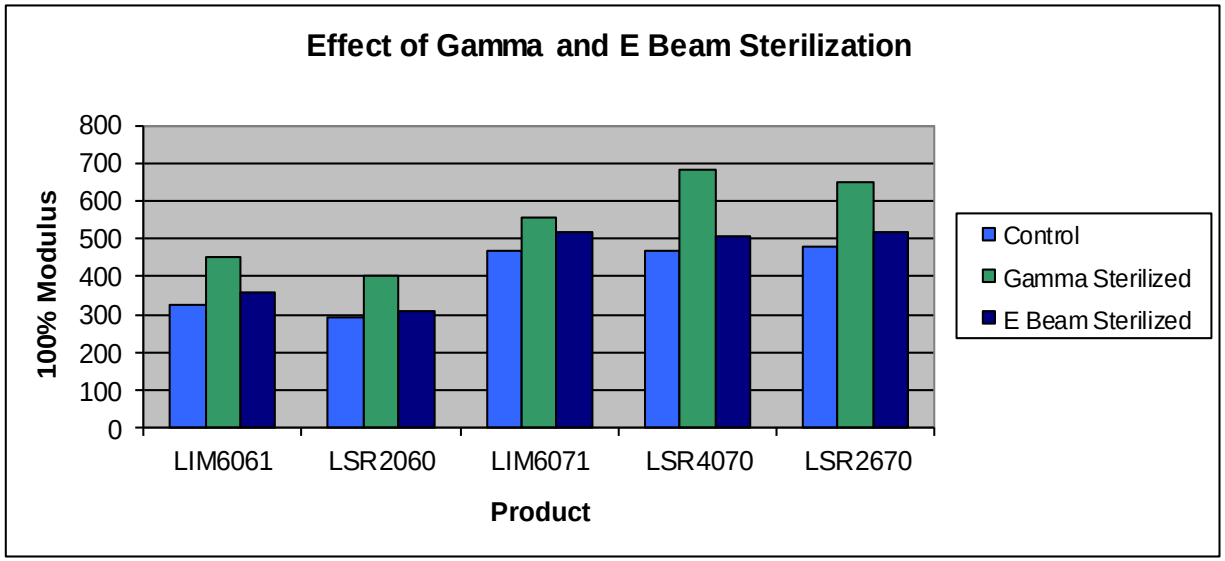
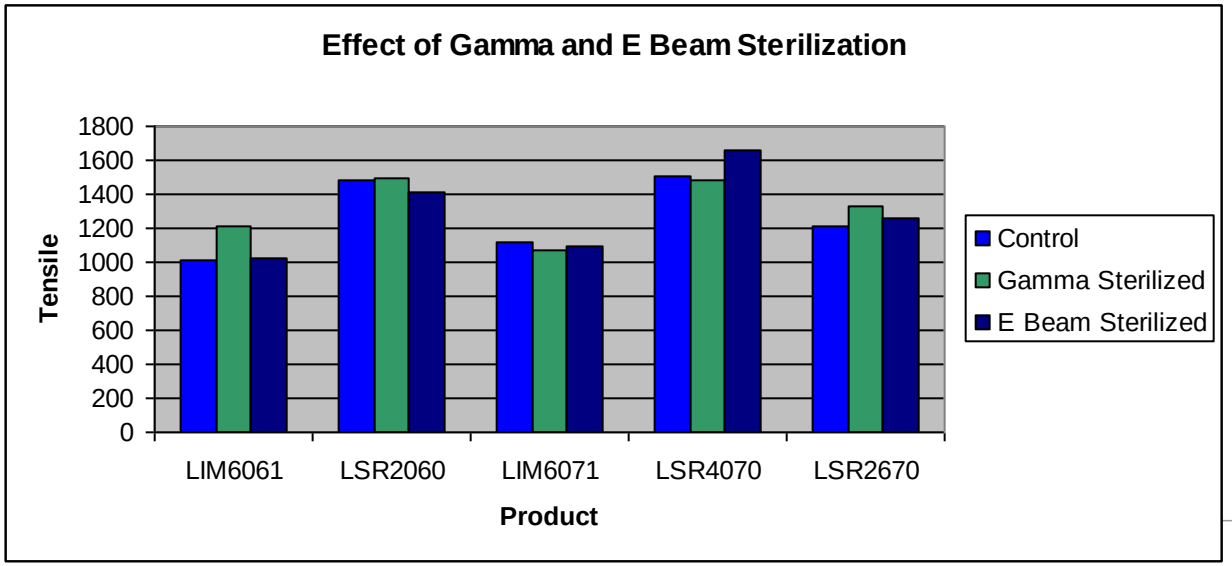
EFFECT OF STERILIZATION ON MODULUS AND TENSILE



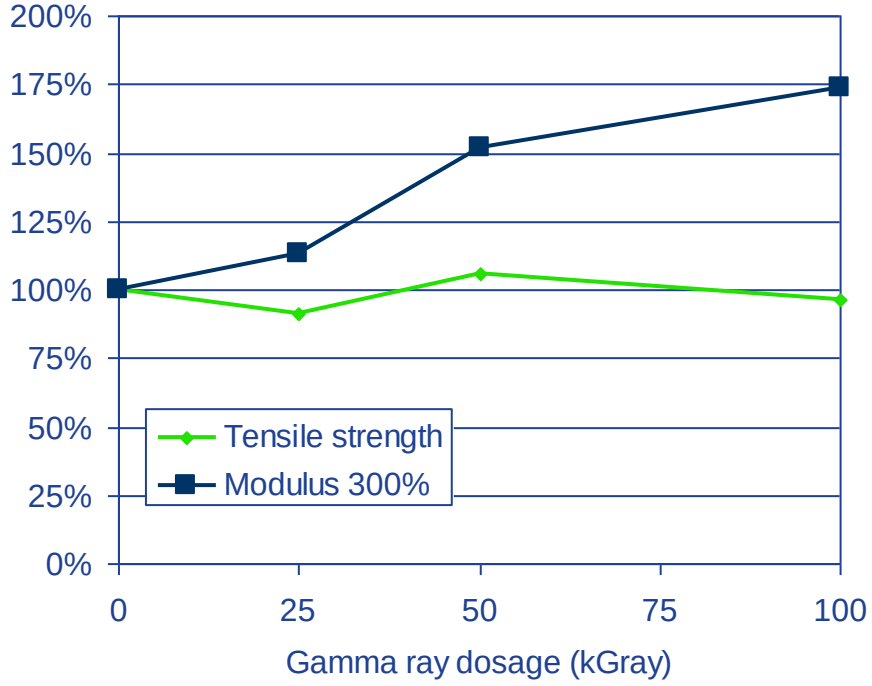


Sterilized at 45-50 kGy

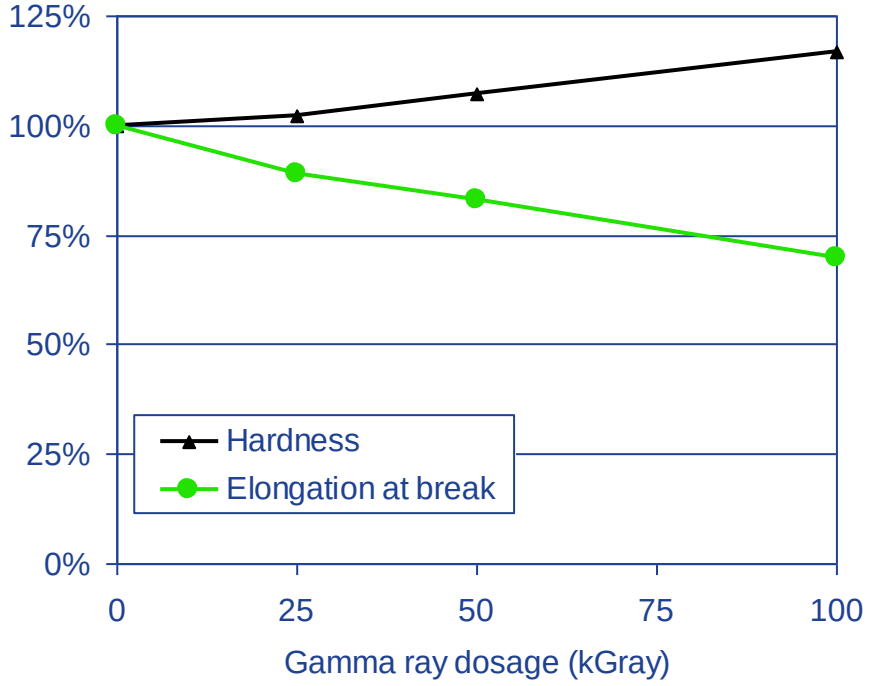
MOMENTIVE™

STERILIZATION RESISTANCE LSR 4040 – GAMMA RADIATION

Resistance of Tensile Strength and Modulus against gamma radiation – LSR4040

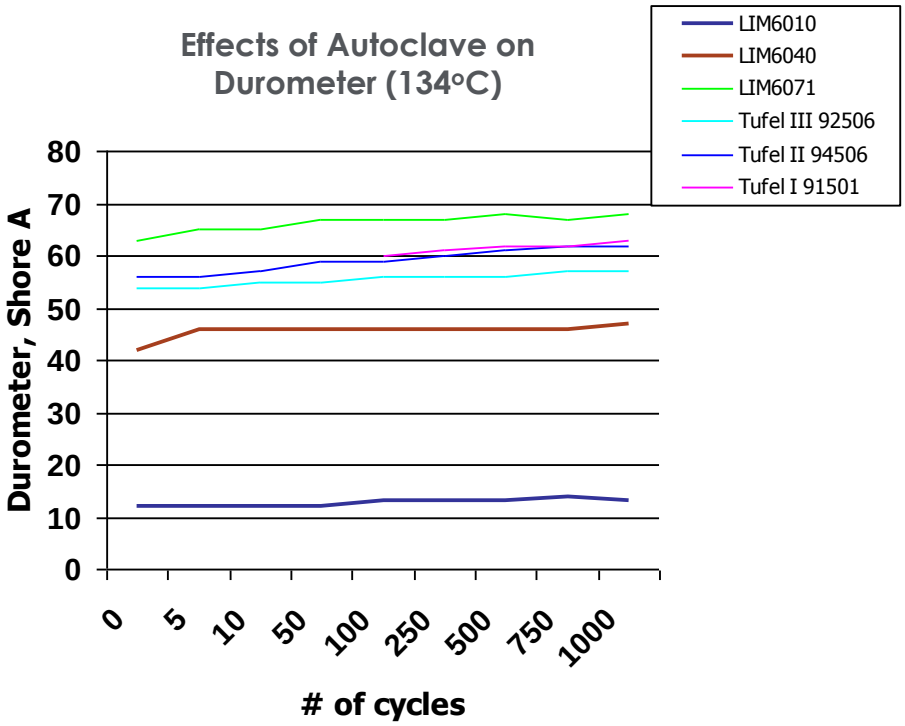


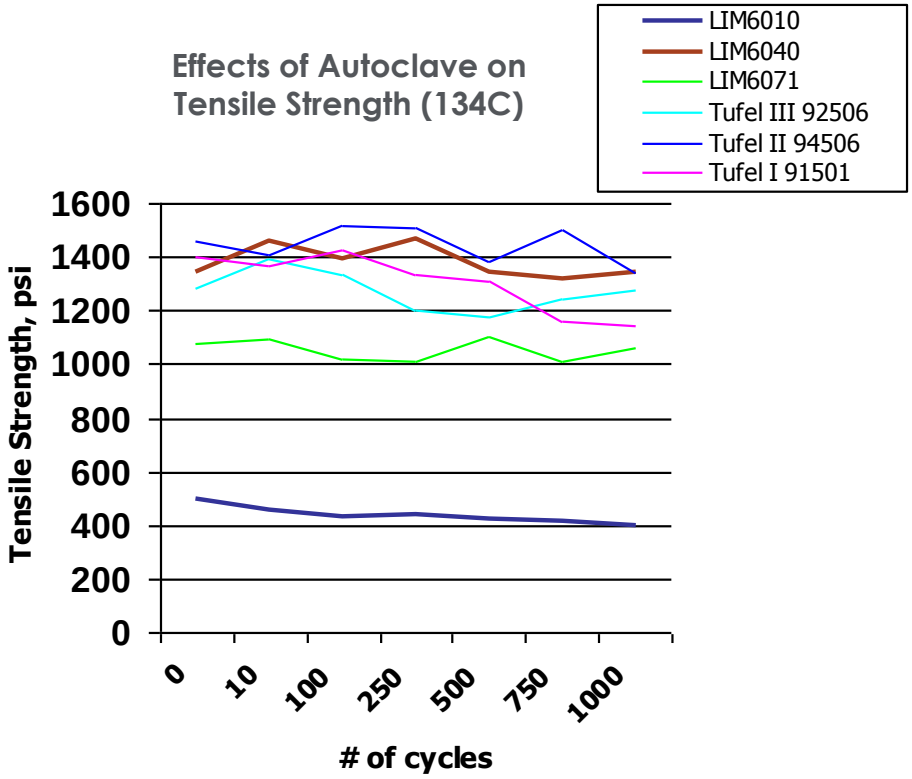
Resistance of Hardness and Elongation against gamma radiation – LSR4040



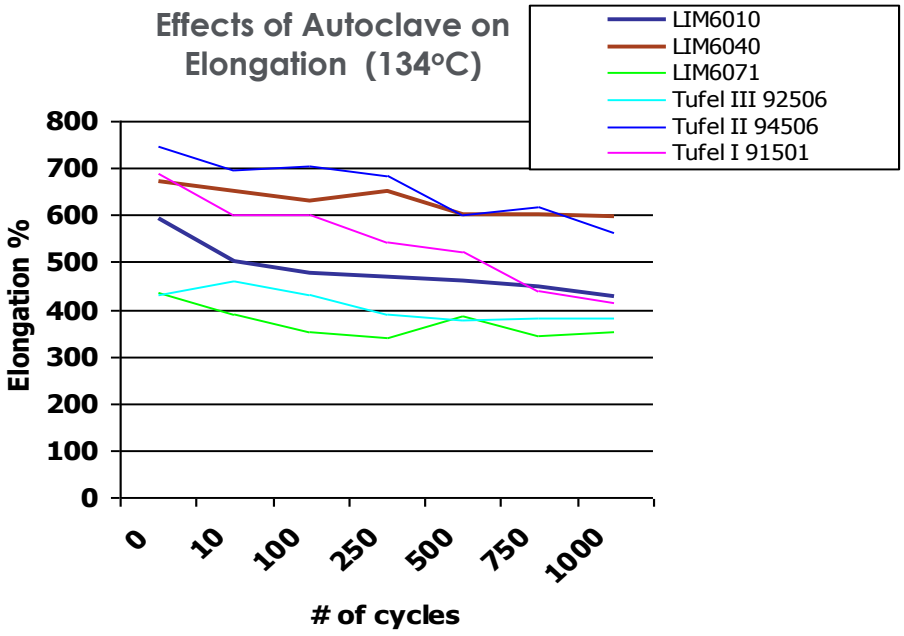
MOMENTIVE™

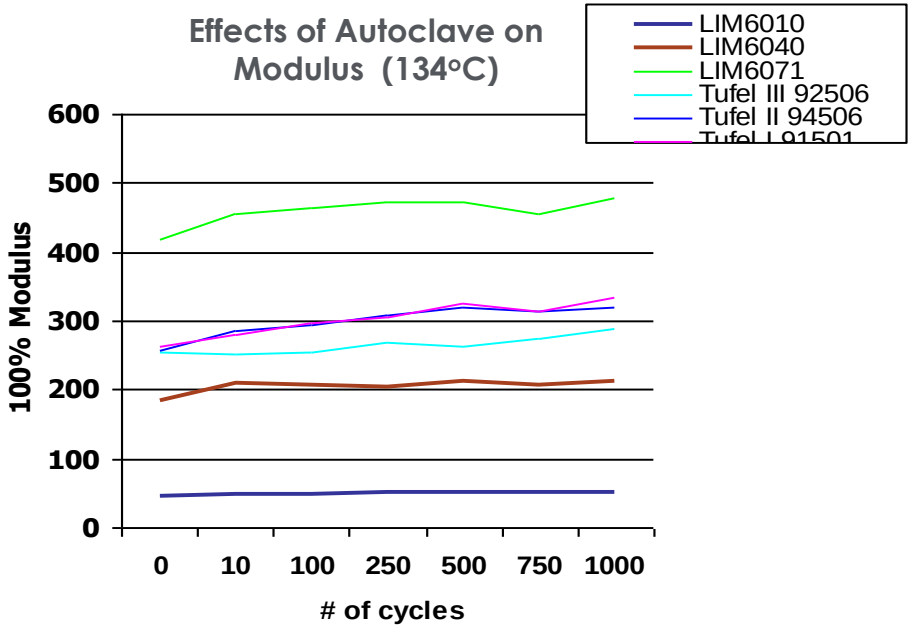
STEAM AUTOCLAVE STERILIZATION STUDIES



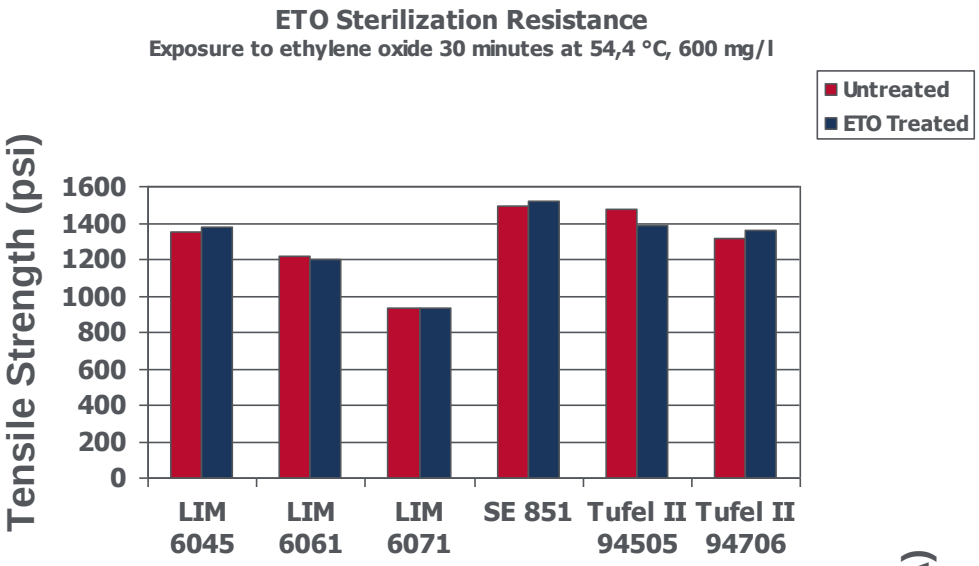


STEAM AUTOCLAVE STERILIZATION STUDIES



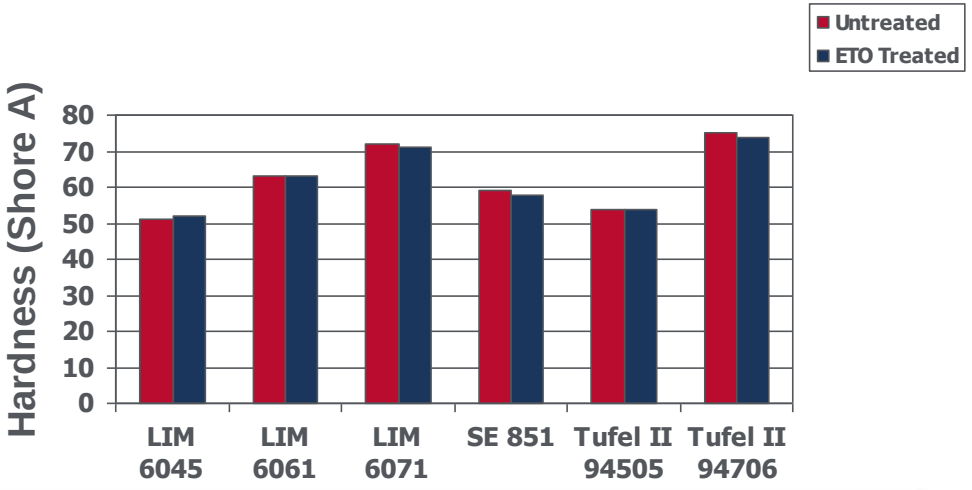


ETO STERILIZATION STUDIES

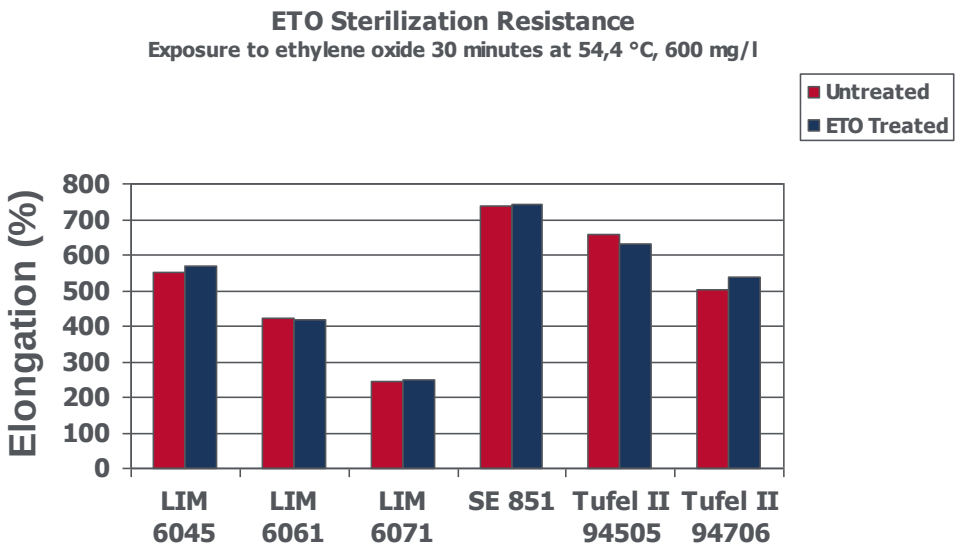


Conditions

EtO concentration	600 mg/L
EtO pressure	26.6 psia
Pre-humidification time at 60% RH	30 min
Pre-Vacuum	1.5 psia
Chamber Temperature	54.4C
Exposure Time	2 Hours
Post vacuum	1.45 psia
Air washes	3



ETO STERILIZATION STUDIES



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