

Characteristics of Urethane, Rubbers and Sponges

Features of High Performance Urethane and Rubber

Urethane Properties

The characteristic values of tensile strength and elongation are tested based on the JIS standard K6251.

Item	Unit	Urethane															
		Standard					Vulkollan®		Abrasion Resistant		Ceramic Urethane				Heat Resistant	Low Rebound	Extra Low Hardness
Hardness	Shore A	95	90	70	50	30	92	68	90	70	95	90	70	50	90	70	15
Specific Gravity	-	1.13	1.13	1.20	1.20	1.20	1.26		1.20		1.13	1.13	1.20	1.15	1.13	1.03	1.02
Tensile Strength	MPa	44	27	56	47	27	46.5	60	44.6	31.3	42	26	53	45	44.6	11.8	0.6
Elongation	%	380	470	720	520	600	690	650	530	650	360	440	680	490	530	250	445
Heat resistance	°C	70					80 (120 deg. for Short Time)		70		70				120	70	80
Low Temp. Resistance	°C	-40		-20			-20		-20		-20				-20	-20	-40

Urethane (Ether Type, Ester Type) Property Comparison

Properties	Ether Type (Shore A95, 90)	Ester Type (Shore A70, 50, 30)
Tensile Strength		○
Elongation		○
Tear Strength		○
Impact Resilience	○	
Abrasion Resistance	○	○
Slip Wear		○
Shock Wear	○	
Hydrolysis Resistance	○	
Oil Resistance		○
Strength		○
Durability		○
Acid Resistance, Alkali Resistance	○	

Discoloration of Urethane

Urethane may experience discoloration and yellowing with age. Urethane turns yellow by aging, but physical property or characteristics remain unchanged. Discoloration is distinct especially with antistatic urethane and Vulkollan®. See the explanation below.

• Aging Discoloration of Antistatic Urethane

 Time to turn yellow and level of yellowing vary depending on operating environment, etc.

• Discoloration of Vulkollan®

Vulkollan® has poorer color stability against ultraviolet rays than general urethanes due to its unique composition. Pictures below show the process of change in colors of a sample exposed to outdoor sunlight.

 No change in physical property or characteristics due to discoloration.

Features of Various Urethanes

Material	Features
Standard Urethane Ether / Ester Polyurethane	Excels in strength in repeat use and shock-absorbing properties. Can be used for applications such as Mechanical Stoppers. Ester Type is Hydrolytic. Do not use in humid and wet areas.
Antistatic Urethane	Excels in antistatic effect. Can be used where mechanical strength and anti-static measures are required.
Heat Resistant Urethane	C This urethane has up to 120°C heat resistance. (70 deg. for the standard urethane) Suitable for use in applications where high material strength in high-temperature range is required.
Super Abrasion Resistant Urethane (Vulkollan®)	Vulkollan® is a super abrasion resistant urethane which is far superior to conventional urethanes in abrasion resistance and load bearing. Excels in tearing strength, 6 times higher in abrasion resistance and 1.5 times in material strength than the standard urethane.
Abrasion Resistant Urethane	Unique composition realized abrasion resistance 2.5 times higher than standard urethane at low cost. Helps to reduce the exchange frequency. Color is dark brown.
Ceramic Urethane	These MISUMI original urethane sheets are unique mixture of ceramic particles . Vulkollan® and Wear Resistant Urethane have resistant property against "surface", and the Ceramic Urethane has resistance against "line" . Compared to the Standard Urethane and various rubbers, the Ceramic Urethane is relatively smooth in its machined surfaces though it is lower in hardness . Note that cutting due to contact may cause dust.

• Characteristic Values of Antistatic Urethane

Specific Volume Resistivity	2.1x10 ¹⁰ Ω·cm
Surface Resistivity	4.0x10 ⁹ Ω

(Test Conditions: Temperature 30°C Humidity 60%)
All other properties are equal to those of urethane of the same hardness.

• Taber Abrasion Test Results

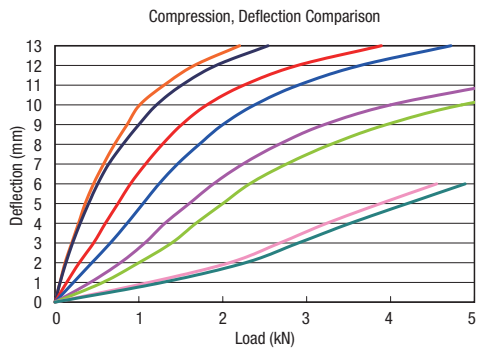
Material	Standard Urethane	Super Abrasion Resistant Vulkollan®	Abrasion Resistant Urethane	Ceramic Urethane
Test				
Abrasion Test (Taber Method)	197.3	33.9	73.8	101
Abrasion Volume (mm ³)				

Testing Method: JIS K 7204:1999 "Plastics - Determination of Resistance to Wear by Abrasive Wheels" Abrasive Wheel: H, 22 Load: 5.0N Number of Strokes: 1,000 Test Parameter: 1
The values are not guaranteed but measured ones.

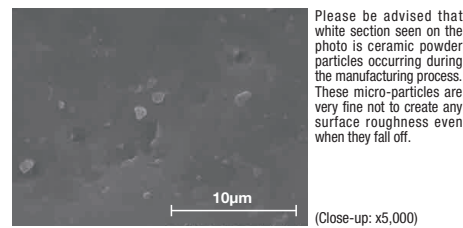
Features of Ceramic Urethane

• Deflection Comparison of Standard Urethane and Ceramic Urethane

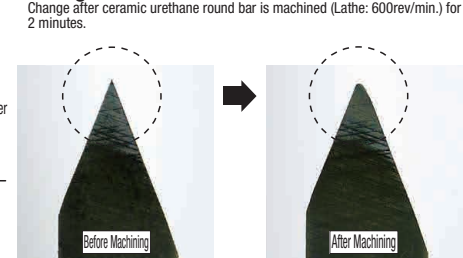
Deflection between the ceramic urethane and the standard urethane differs when the same load is applied. Careful consideration should be given for replacement.



• Enlarged View of Ceramic Urethane



• Change after Ceramic Urethane is Machined



Rubber Properties

The characteristic values of tensile strength and elongation are tested based on the JIS standard K6251.

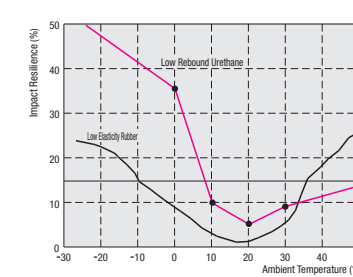
Item	Unit	Nitrile Rubber (NBR)		Chloroprene Rubber (CR)	Ethylene Rubber (EPDM)	Butyl Rubber (IIR)	Fluororubber (FPM)		Silicon Rubber (SI)		Low Elasticity Rubber (Hanenaito®)	Natural Rubber (NR)		
		70	50	65	65	65	80	60	Standard	High Strength	57	32	45	
Hardness	Shore A	70	50	65	65	65	80	60	70	50	57	32	45	
Specific Gravity	-	1.6	1.3	1.6	1.2	1.5	1.8	1.9	1.2	1.2	1.3	1.2	0.9	
Tensile Strength	MPa	12.7	4.4	13.3	12.8	7.5	12.5	10.8	7.4	8.8	7.8	8.3	10.3	16.1
Elongation	%	370	400	460	490	380	330	270	300	330	400	810	840	730
Maximum Operating Temperature	°C	90	99	100	120	120	230	230	200	200	60	60	70	
Temperature of Continuous Use	°C	80	80	80	80	80	210	210	150	150	30	30	70	
Low Temp. Resistance	°C	-10	-10	-35	-40	-30	-10	-10	-70	-50	10	10	0	

Features of Low Rebound Urethane and Low Elasticity Rubber (Hanenaito®)

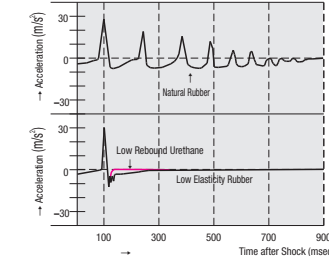
• Low Rebound Urethane
It has the same properties as urethane, and excels in shock absorption. With more resistance to permanent compression than standard urethane, it is hard to deform. Not suitable for absorption of large impact energy because its tensile strength and elongation resistance are weaker than that of urethane of the same hardness.

• Low Elasticity Rubber (Hanenaito®)
Hanenaito® is a registered trademark of Naigai Rubber Industry Co., Ltd. It is used as cushioning material for pallet damper, conveyor machine, precision instrument etc, because of its good elongation and shock absorption. Also it is used as vibration absorption materials of various precision instruments because of its excellent vibration absorption.

• Impact Resilience Variation by Temperature of Low Elasticity Rubber and Low Rebound Urethane

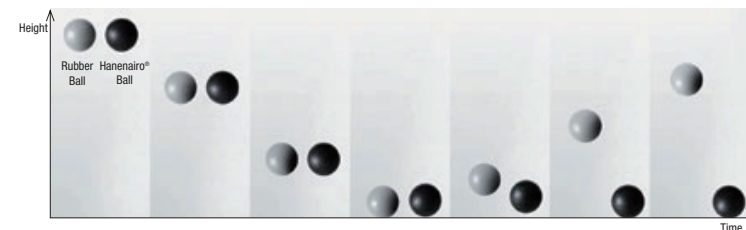


• Shock Absorption Comparison of Low Elasticity Rubber and Low Rebound Urethane



Listed values are for reference, not guaranteed.

Drop Comparison of Rubber Ball and Hanenaito® Ball

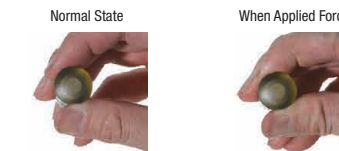


Elasticity of Shock Absorbing Gel P410, 435

• Shock Absorbing Gel



• Urethane, Shore A50



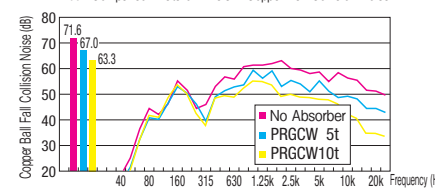
A major characteristic is the three-dimensional slow recovery, the function to recover after compression slowly and in multiple directions. Pressed as thin as shown in the photo and recovers to the original shape gradually after being released from pressure.
* The double-layer structure of the gel part reduces stickiness.

Features of Shock Absorbing Foam P435

Excellent sound damping and vibration absorbing characteristics. Flexible material can be pasted on curved surfaces with ease. Lightweight material can be applied on large panel areas. Best suited for human body protection. Can be pasted in multi-layers where more protection is needed.

Steel Ball Collision Noise Level Test

PRGCW Comparison Data of PRGCW Copper Ball Collision Noise



Item	No Absorber	PRGCW5	PRGCW10
Collision Noise (dB)	71.6	67	63.3
Sound Pressure	-	40% Reduced Sound Pressure	60% Reduced Sound Pressure

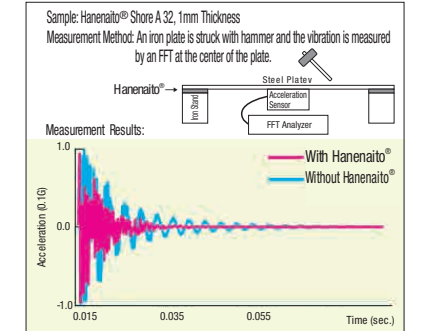
* A steel ball (φ20, 36g) is dropped on a wooden base from a 55cm height, and the sound pressure level is measured with a microphone at a distance of 50m, positioned 50cm above the ground.

Reference: Compression Set of Low Rebound Urethane

Low Rebound Urethane	1%
Urethane (Shore A70)	25%

* The above data is measured at room temperature 23°C.
* 70°Cx24H 25% Compression

Hanenaito® Comparison of Damping Effects



• Correlation of Hardness and Rebound Force of Shock Absorbing Materials

Rebound	Hardness	
	Extra Low (F Hardness)	High (A Hardness)
Low	Shock Absorbing Gel	Low Rebound Urethane Low Elasticity Rubber
Large		General Purpose Urethane General Purpose Rubber

• Properties of Shock Absorbing Gel

Item	Unit	Shock Absorbing Gel
Specific Gravity	-	1.0
Hardness	Asker F	75
Tensile Strength	MPa	0.81
Elongation	%	885
Heat resistance	°C	100
Low Temp. Resistance	°C	-10

* Above figures are the measured values for the shock absorbing gel as a material, and there are slight differences between the values for the bumping products made with this material featured on P410, 435.

Features of Special Urethane Foam SOFRAS® P446

This special urethane foam excels in water retention and abrasion resistance allowing it to be used in industrial purposes such as application and moisture absorption. SOFRAS® excels in abrasion resistance and requires less concerns about dust shedding, whereas the use of sponges and felts may result in shedding of dust and felt fiber.

• Enlarged Photo of Grease-impregnated Special Urethane

