

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	1.15	1.20	1.26		1.13		1.13	1.13	1.20	1.15	1.13	1.03	1.02
Tensile Strength	MPa	44.1	44.6	31.3	27.4	18.5	46.5	60	44.6	31.3	42	26	53	45	44.6	11.8	0.6
Elongation	%	400	530	650	690	600	690	650	530	650	360	440	680	490	530	250	445
Heat	°C	70					80 (120 for Short Time)		70		70				120	70	80
Low Temp. Resistance	°C	-40		-20			-20		-20		-40				-20	-20	-40

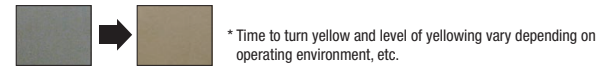
Urethane (Ether Type, Ester Type) Property Comparison

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



· 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.



Features of Urethane

Material	Feature
General 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	This urethane has greater heat resistance up to 120°C. (70°C for the general 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 general urethane.
Abrasion Resistant Urethane	Unique composition realized abrasion resistance 2.5 times higher than general 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, excelling in abrasion resistance and have smooth machined surface in spite of its low 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

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

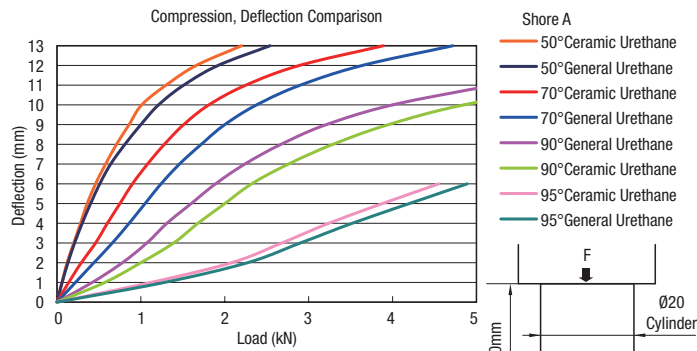
· Taber Abrasion Test Results

Test	Material	General Urethane	Super Abrasion Resistant Urethane	Abrasion Resistant Urethane	Ceramic Urethane
Abrasion Test (Taber Method)	Abraded Volume (mm ³)	197.3	33.9	73.8	101

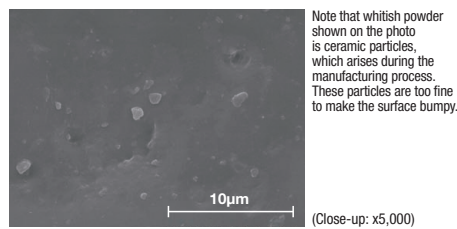
Testing Method
JIS K 7204: 1999 "Plastics - Determination of Resistance to Wear by Abrasive Wheels"
Abrasive Wheel: H 22 Load: 9.8N
Number of Strokes: 1,000 Test Parameter: 1
The values are not guaranteed but measured ones.

Features of Ceramic Urethane

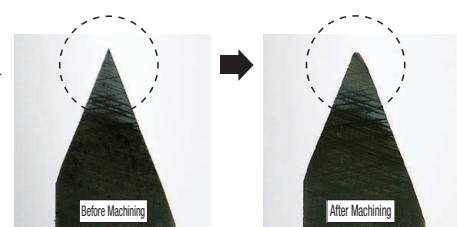
Deflection comparison of general urethane and ceramic urethane. Deflection between the ceramic urethane and the general urethane differs when the same load is applied. Careful consideration should be given for replacement.



· Enlarged Photo of Ceramic Urethane



· Change after Ceramic Urethane is Machined



Rubber Properties

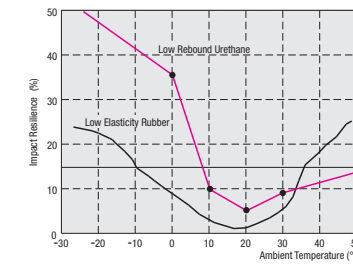
The characteristic values of tensile strength and elongation are tested based on the JIS standard K6251.

Item	Unit	Nitrile Rubber (NBR Nitrile Rubber)		Chloroprene Rubber (CR)	Ethylene Rubber (EPDM Synthetic Rubber)	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	

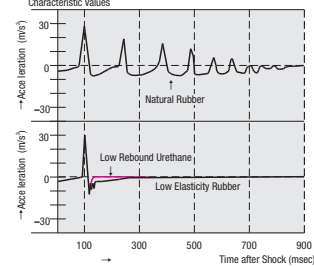
Features of Low Rebound Urethane, Low Elasticity Rubber (Hanenaito®)

Low Rebound Urethane: It has the same properties as urethane, and excels in shock absorption. With more resistance to compression than normal 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 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 characteristics.

Impact Resilience Variation by Temperature of Low Elasticity Rubber, Low Rebound Urethane

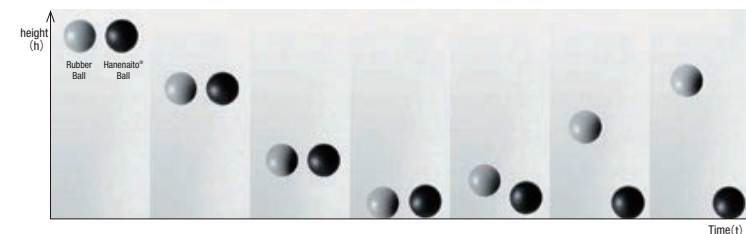


Shock Absorption Comparison of Low Elasticity Rubber, Low Rebound Urethane



Above data are standard values, not guaranteed values.

Drop Comparison of Rubber Ball and Hanenaito® Ball



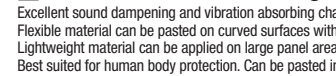
Elasticity of Shock Absorbing Gel P.390, 415

· Shock Absorbing Gel



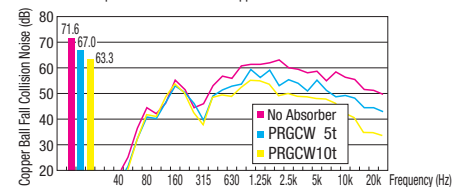
A major characteristic is the three-dimensional slow recovery, the function to recover after compression slowly and in multiple directions. Pressed as thin as shown in the photo and recovers to the original shape gradually after being released from pressure.
The double-layer structure of the gel part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

· Urethane Shore A50



Steel Ball Collision Noise Level Test

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

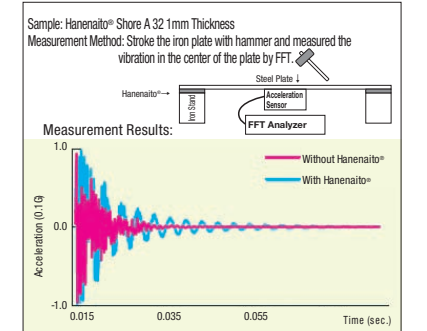
*A steel ball (200, 36g) is dropped on a wooden base from a 55cm height, and the sound pressure level is measured with a microphone at a distance of 50m, positioned 50cm above the ground.

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

		Hardness	
		Extra Low (F Hardness)	High (A Hardness)
Rebound	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	°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 P.390, 415.

Features of Special Urethane Foam SOFRAS® P.426

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

