2021
Sustainability
Report

通用 GS 矽酮
GENERAL SILICONES

SUSTAINABILITY OF SILICONE

A MATERIAL BRINGS PURITY TO YOUR LIFE

Silicones are one of the sustainable biocompatible man-made polymer material derived from silica which is the second most abundant mineral on Earth. Silicone products resist oxidative deterioration due to heat, temperature, electric, chemicals, UV/Ozone/ X-ray radiation etc.; thus it reduces the environmental impact. Also, the use of silicones generates energy savings and reduces CO_2 emission 9 times greater than the impacts of production and recycling. Silicone is one of the best alternative, reusable, non-toxic materials that can avoid over a single-use plastic materials polluting our oceans and landfills.

1 What is Silicone ?

What is Silicone made of?

Silica

Chemically, silica is an oxide of silicon, viz., silicon dioxide, and is generally colorless to white, most commonly found in nature as quartz and in various living organisms. It is the major constituent of sand and one of the most complex and abundant families of materials, existing as a compound of several minerals and as synthetic product. Notable examples include fused quartz, fumed silica, silica gel, and aerogels. It is used in structural materials, microelectronics (as an electrical insulator), and as components in the food and pharmaceutical industries.

Silicone

Silicone, by contrast, is a synthetic polymer made up of silicon, oxygen and other elements, most typically carbon, hydrogen and sometimes other elements. They are typically heat-resistant and either liquid or rubber-like, and are used in sealants, adhesives, lubricants, medicine, cooking utensils, and thermal and electrical insulation. Some common forms include silicone oil, silicone grease, silicone rubber, silicone resin, and silicone caulk.

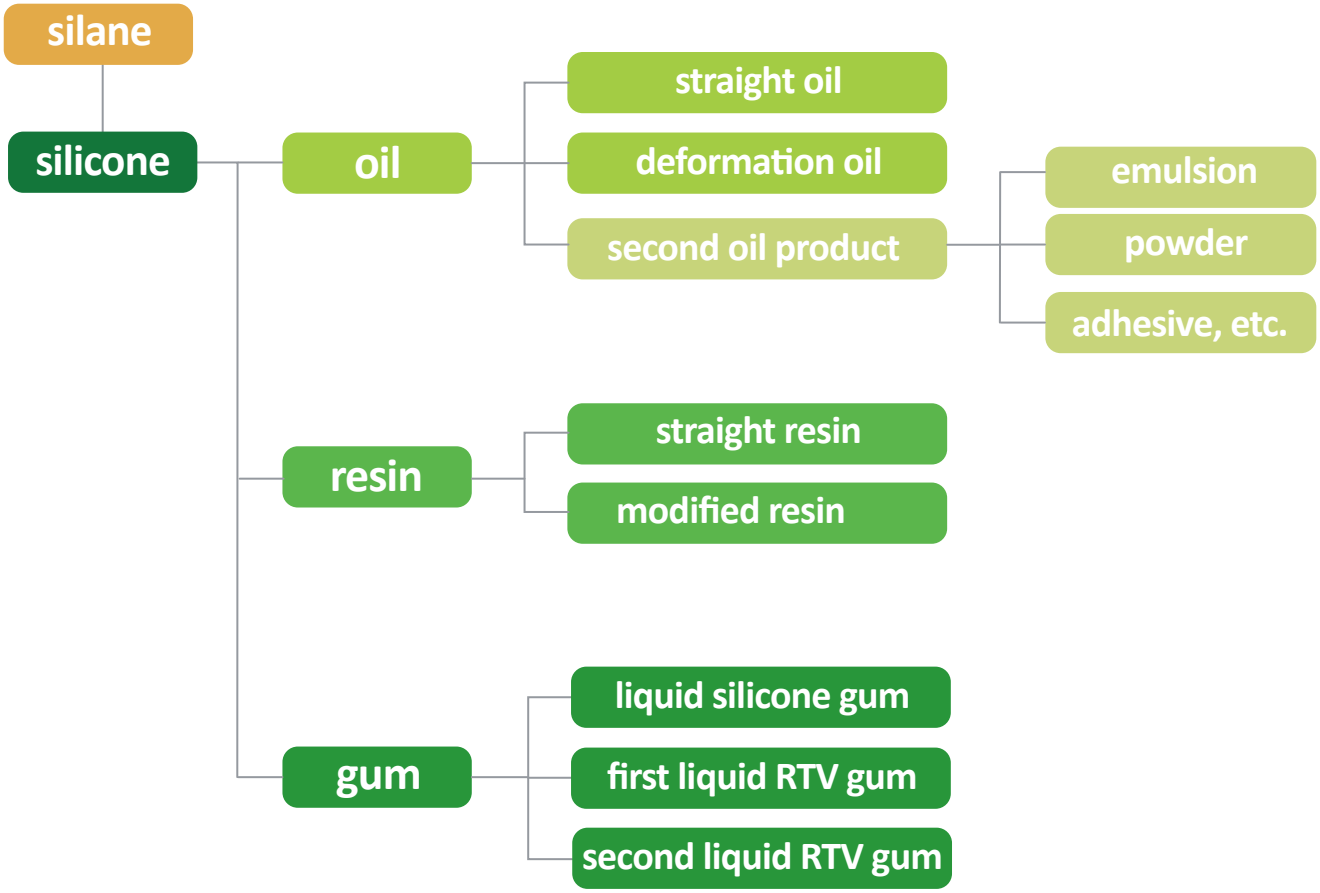
Silicon

Silicon is a base element with the symbol Si which makes up silica. It is a hard, britile crystalline solid with a blue-grey metallic lustre. It is the second most common element in the universe by mass, but rarely occurs in its elemental form and is made by heating silica at very high temperatures. Silicon vs. Silicone, many take the two as one thing, because they are almost spelled the same and sounded similar. But, they are different. Silicon is the basis of the widely used synthetic polymers called silicones.

“In short, silicon is a naturally occurring chemical element, whereas silicone is a synthetic polymer material derived from silicon.”

What types of silicone are there?

Silicone can be divided into oil, resin, gum according to its state, as described below. Silanes are hydrolyzed and polymerized to produce silicones, which are polymers.



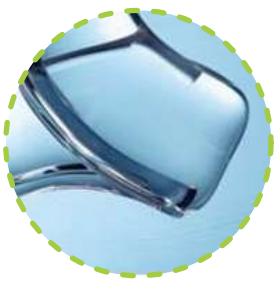
silicone oil

Silicone oil is any liquid polymerized siloxane with organic side chains. It has relatively high thermal stability and their lubricating properties.

silicone resin

Silicone resin is a type of silicone material which is formed by branched, cage-like oligosiloxane. It is used in pressure-sensitive adhesives, silicone rubbers, coatings and additives.

silicone gum



Silicone gums are designed to protect electrical components from dust, moisture and shock.

Is Silicone Sustainable?

Natural

Silicone is made in part with silicon, which is the second most abundant element in the Earth's crust, after oxygen. Some pure platinum food grade silicones are made from sand (silica) and carbon, natural resources.

Non-toxic

Some silicone products are food-grade silicone that is made without petroleum-based chemicals, BPA, BPS, or fillers.

Eco-friendly

A small amount of silicone being used will lead to huge reductions in greenhouse gas emission. Use of silicone products can reduce CO_2 emission by 9 times.

Durable

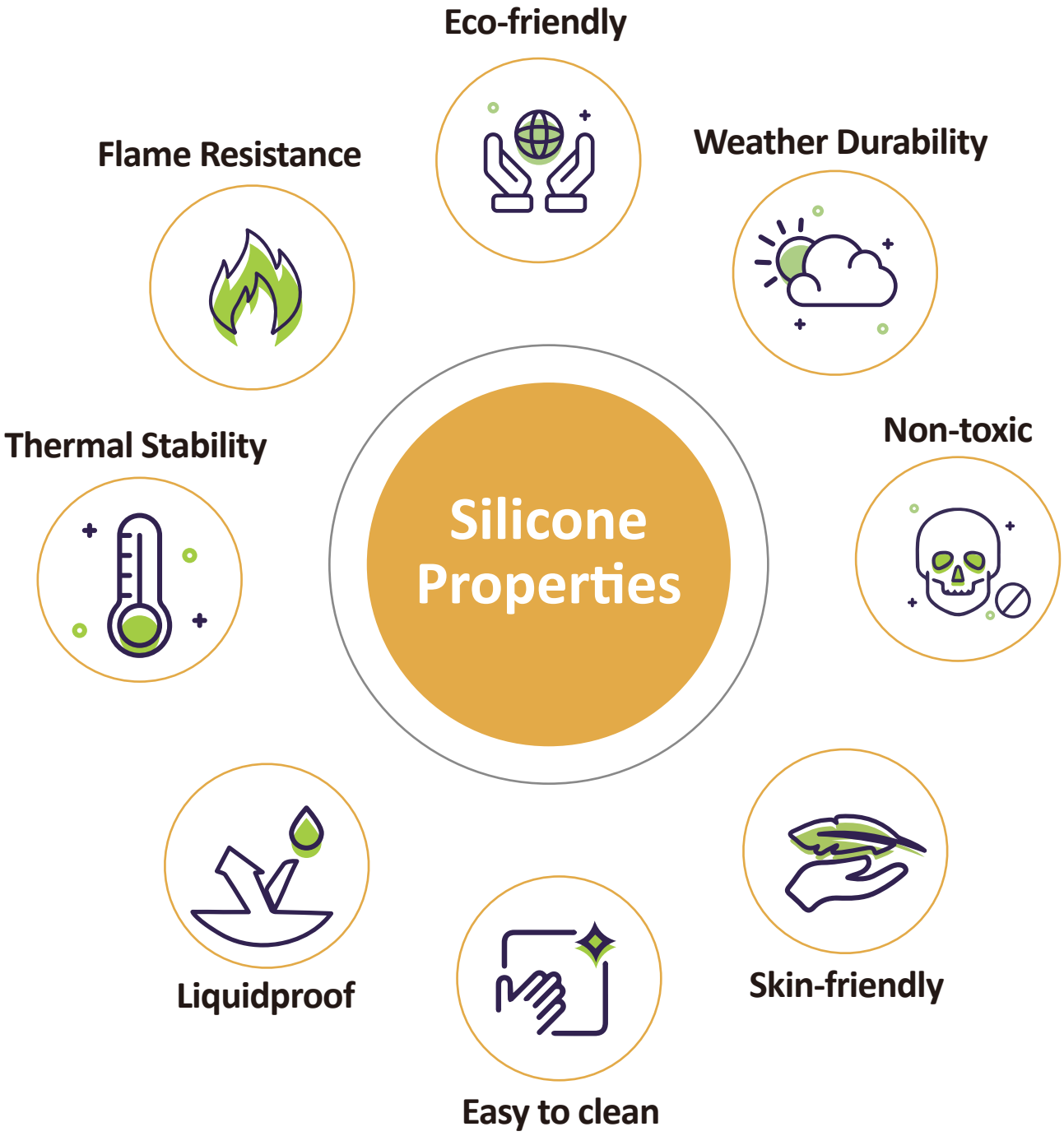
Compared to plastics, silicone is long-lasting and endures extreme temperature fluctuations without melting, cracking or otherwise degrading. Also it resists oxidative deterioration (normal aging) for decades on end which consequently increases the product lifecycle.

Harmless

If disposed of at a landfill for incineration, the silicone (unlike plastic) is converted back into inorganic, harmless ingredients: amorphous silica, carbon dioxide, and water vapor.

2 Silicone vs. Plastic

Silicone Properties



Silicone VS. Plastic

Characteristics	SILICONE	PLASTIC
Raw materials use	**NATURAL** Silicone is made with the abundant natural resource, silicon.	**NON-RENEWABLE** Generally made from fossil fuel feedstock (fossil fuels being a non-renewable resource).
Temperature resistance	**YES** Silicone can withstand extreme high and low temperatures without degradation.	**NO** Plastic will degrade and badly effect the environment at high temperatures.
Durability	**YES** Endures for decades unchanged.	**NO** Cracks, degrades, stiffens with age.
Recyclability	**LIMITED** Can be recycled. Safe to incinerate.	**LIMITED** Although few plastics can be recycled but majority of them can't be recycled.
Sustainability	**YES** Dishwasher safe. Or by hand!	**NO** Hand wash only. Not heat safe.
Food safety	**YES** Nontoxic and safe for contact with food and drink.	**NO** Not safe for food packaging as it is harmful for health.
Renewable energy	**YES** Used to produce solar, water and wind energy.	**NO** Degradation is observed very easily.

"When it comes to the environment, silicone is highly durable & more friendly than plastic, and safer for human health."

Life Cycle of Green Products

Silica (SiO_2)

Nature, it's the most abundant compound in the Earth.

Silicon Metal (Si)

For semiconductor the second most abundant element in the Earth's crust.

1 Raw Material Extraction

2 Material Processing

Silicone

-Non-toxic
-Free of BPA / BPS
-RoHS & Halogen pass
-REACH pass
(beside D4/D5/D6)

*Silanes / Siloxanes

3 Manufacturing

Production Silicone Products

-Low VOCs
-Reduces CO_2 emission
-Save energy
(Water/Electricity)

4 Product

Silicone Products are:

-Highly durable
-High temperature resistance
-Resistant to hydrolysis
-Reusable
-Extend the lifespan of products.

5 Disposal

Harmless Ingredients

Disposed of landfill can be converted harmless ingredients : amorphous silica, carbon dioxide and water vapor.

3

Silicone : Toxic or Non-toxic ?

Environmental Certifications

Silicones are one of the bio-friendly and sustainable materials of choice and widely recognized in large volume applications in industries like health care, electronics, automotive, aerospace, industrial assembly, building, textile, consumer etc. It is resistant to many environmental factors such as heat, temperature, electric, chemicals, UV/Ozone radiation and X-rays. Various varieties of silicones are available each of which have potential applications ranging from food to medical grade products. Silicones don't contain BPA, latex, lead, or phthalates, all of which are toxic chemicals present in plastics that can lead to cancer, infertility, immune disorders. Many researchers and groups have evident data to prove the non-toxic behavior of silicones. For example, Health Canada states: "There are no known health hazards associated with use of silicone cookware. Silicone rubber does not react with food or beverages, or produce any hazardous fumes." Also CES-SILICONES EUROPE has reported the behavior of silicones in the main environmental compartments of water, sediment, soil and air to prove its non toxicity. Experiments have concluded that silicones don't come under Volatile Organic Compounds (VOCs) category as there is zero ground level ozone pollution due to them. Also there is no evident data to prove that silicone being in soil can affect worms or crops grown in sewage proving it safe for soil living animals and plants.

Silicone is Non-toxic

> There are several classes of silicones that may potentially be found in the environment on account of their applications, but the two principal groups are VMS and PDMS. The picture below summarises their behaviour in the main environmental compartments of water, sediment, soil and air.

Air

Experiments also show that siloxanes do not contribute to ground level ozone pollution, and because of this, have not been classified as Volatile Organic Compounds (VOCs). On account of their relatively short atmospheric life they do not reach the upper atmosphere to affect the ozone layer.

Soil

In view of the significance of the soil compartment in the life cycle of PDMS, a number of studies have been conducted on various soil-living animals and plants. For example, there was no evidence of uptake or adverse effects on worms or crops such as wheat or soybeans grown in sewage sludge amended soils containing PDMS.

Water

Silicones can be used to protect wildlife. A major such use was the treatment with PDMS of otters caught in a large oil spill in Arctic waters. After using detergents to remove the oil, a PDMS coating gave their fur the necessary protection against the freezing waters until their natural waterproofing system could recover.

Sediments

A minor percentage (less than 5%) of silicones adheres to suspended solids in the water outlet of treatment plants and may become part of river sediments. In laboratory experiments with PDMS on a number of sediment-living organisms, such as worms and insect larvae, no adverse effects were seen even at high concentrations.

(Information reference : CES-SILICONES EUROPE- https://www.silicones.eu)

4 Silicone Applications

Silicone Applications

Silicones have become the most popular and adaptable man-made polymeric materials and are constantly marketed as safe replacements for traditional plastics. It can take various physical forms ranging from solid rubbers to viscous oils and pastes. Use of silicones has revolutionized products in critical fields like medicine, technology, engineering, transport and energy.

Healthcare

Silicone products are being used widely in the medical and healthcare applications. Silicones can enhance healing and comfort as the human skin and body filly accepts it with ease. Also, silicone based infant care products meets the highest standards demanded by professionals. They are apt for prosthetics devices as they have hypoallergenic properties and wide range of physical properties.

Transport

A variety of silicone products are being used in the transportation sector as there is a freedom in design, color, hardness and surface of products. Due to its temperature stability range, non-flammable and heat retardant property it is also preferred in railways and aerospace industry.

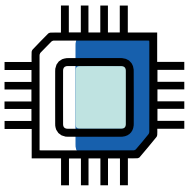
Consumer Product

With the trends of eco-friendly conscious lifestyle, silicone based consumer products cover a very large market area and continue to grow exponentially in coming years. It ranges from household products, baby products, gadgets to fashion accessories. Not only it comes with these properties but also provides ultimate and long lasting experience.

Textile

Silicone technology has revolutionized the textile industry by providing ways to manufacture functional and intelligent textiles. Silicones open up a pathway to design durable, lightweight, comfortable sportswear too.

Silicone Applications



Electronics

In electronics industry silicones are widely used as encapsulates as they protect the device from heat, moisture, contamination, and accidental damage. Also, with the advancement in the past decades silicones are one of the promising substrates for Flexible hybrid electronics applications.

Energy

Renewable energy products also use a wide variety of silicones either as raw materials or components. Silicones are used in most of the solar panels to enhance the durability and functionality, thus helps to produce solar energy also.

Engineering

Material and product engineering for innovation is continuing since long time. Silicone raw materials and products help in these areas too like surface engineering or sealants and many more.

5 Target & Mission

About General Silicones

GENERAL SILICONES

Story of 50 years of silicone sustainability

General Silicones (GS) was founded in 1970 in Taipei, Taiwan, and is now represented worldwide – including Europe, China, Japan, and South East Asia countries. GS is not only a major distributor of silicone materials but also an active silicone products manufacturer with ISO 9001, IATF 16949, and ISO 14001 certifications. The company has manufacturing plants in Hsinchu, Taiwan; Wujiang, China; and Bac Giang, Vietnam. With decades of experience in this field, GS has the ability and capacity to provide a wide range of silicone products for many industries, including medical, automobile, consumer products, electronics, and IT.

With regards to the GS vision for the next 50 years, expanding the uses of environmentally friendly silicone material and minimizing the use of plastics to lower carbon emissions are the primary goals. A key example of GS focus on contributing to a more environmentally sustainable society is ***Compo-SiL®*** technology for improving silicone adhesion and bonding using sustainable technology. ***Compo-SiL®*** silicone rubber applications will be increased to reduce and minimize the production and use of plastics to achieve the Group's sustainable management philosophy and mission to protect the environment.

About *Compo-SiL®*

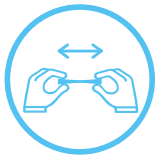
Compo-SiL®

Part of your life

The brand name "***Compo-SiL®***" is a compound word of the roots "composite" and "silicone". ***Compo-SiL®*** represents over 50 years material developing technologies and manufacturing capability of the General Silicones beginning with the sales business of raw materials, to OEM, and the self-owned brand to date.

Key Performance Properties

Silicone layer


Highly elastic


Waterproof


Glossy surface


Highly transparent


Thermally conductive


Highly biocompatible


Weather resistance


Hydrolysis resistance

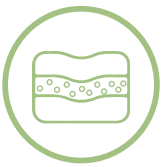

Electrically insulating /conductive

UV resistance

Modified layer


Printable


Laminable


PU foam

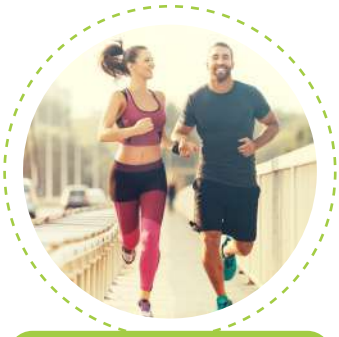

High temperature resistance


Adherable

About *Compo-SiL®*

APPLICATIONS

Through the interface bonding technology of ***Compo-SiL®***, silicone and it's well known eco-friendly and functional properties could be easily applied and enhanced with unmet possibilities using a diverse selection of adhesives. As GS is deeply involved solving the bonding problem of silicone with other substrates, ***Compo-SiL®*** is here to help and makes silicone applicable towards many industries, such as textile, flexible hybrid electronics, medical, vegan leather, fire and safety etc. with unlimited and innovative design of freedom.



Textile Accessories

Flexible Hybrid Electronics

Compo-SiL®

Vegan Leather

Fire Safety

Medical

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GENERAL SILICONES
No.9-1, Lane 52, Nan-Kang St., Hsiang-Shan,
Hsin-Chu City, Taiwan, R.O.C. 30095
Tel：+886-3-537-2181
Fax：+886-3-537-7508

GS Website

Compo-SiL® Website

Compo-SiL® LinkedIn

Compo-SiL® Facebook

Compo-SiL® YouTube