

# Unit III

Inorganic Chemistry (B-306)

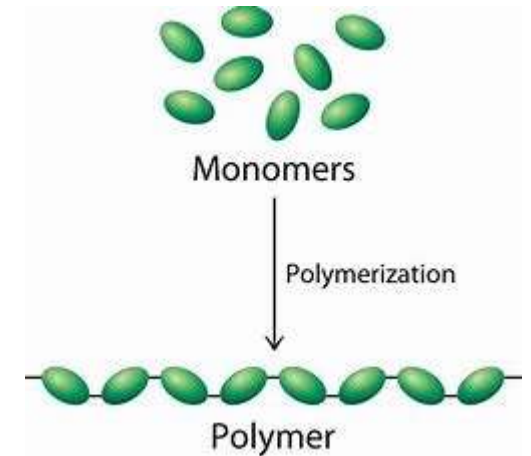
Dr. Sachin Kumar

## Unit III

# Silicones and Phosphazenes

### Silicones:

Silicones are a new type of synthetic polymers. The word polymer represents a material made of smaller, repeating chemical units called monomers, that are bonded together to form a long chains molecule and usually the number of repeating units can range from one to several thousand. Silicone polymers or simply “Silicone” consists of a silicon-oxygen backbone, with “sidechains” consisting of hydrogen and/or hydrocarbon groups attached to the silicon atoms. Due to lack of carbon atoms in its backbone, silicone is considered as an inorganic polymer, which differs from the many organic polymers whose backbones are made of carbon. A general formula for silicones is  $(R_2SiO)_x$ , where R can be any one of a variety of organic groups though, it mainly consists of methyl/vinyl or phenyl groups attached to silicon. They are also called as poly-siloxanes.



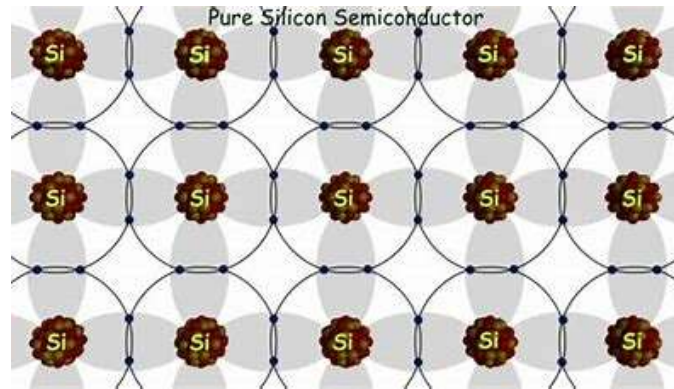
The silicon-oxygen bonds in the silicone backbone are highly stable, binding together more strongly than the carbon-carbon bonds present in many other polymers. The inorganic siloxane backbone (- Si - O - Si - ) is the most flexible polymer backbone, due to high degree of electrovalent bonding character of - Si - O- bond, available. Thus, silicone tends to be more resistant to heat than conventional, organic polymers. It's important to note that the Silicone's side-chains render the polymer hydrophobic, making it useful for applications that may require repelling water. The sidechains, which most commonly consist of methyl groups, also make it difficult for the silicone to react with other chemicals and prevents it from sticking to many surfaces. These properties can be tuned by changing the chemical groups attached to the silicon-oxygen backbone.



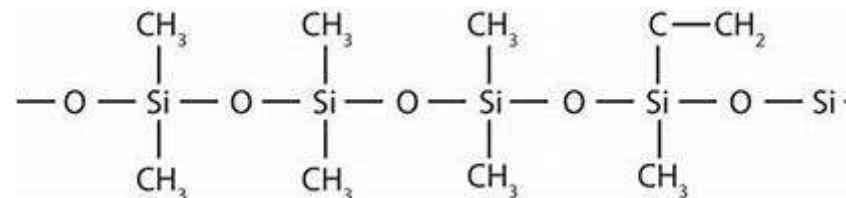
## Silicone vs. Silicon

Though “silicone” and “silicon” are spelled similarly, they are not the same.

Silicone contains [silicon](#), an atomic element with an [atomic number](#) of 14 in the periodic table. Although it does not occur naturally in free form, in its combined form it accounts for about 25% of the earth's crust and uses, most notably as a [semiconductors](#) in electronics.



Silicone, on the other hand, is man-made and does not conduct electricity, as it is an [insulator](#).



Atomic Number (Number of Protons or Electrons) — 14  
Chemical symbol (Si = Silicon) — Si  
Atomic Weight (relates to total particles in atom) — 28.09  
Number of electrons in each shell (starting at K shell) — 2,8,4

The periodic table shows Silicon (Si) highlighted in orange. An orange arrow points from the element's box to the summary statistics provided above. The periodic table includes elements from Hydrogen (H) to Oganesson (Og), with the Lanthanide and Actinide series shown below the main body.

## Discovery of Silicone

The chemist Frederic Kipping first coined the term “silicone” to describe compounds he was making and studying in his laboratory. He reasoned that he should be able to make compounds similar to the ones that could be made with carbon and hydrogen/oxygen, since silicon and carbon shared many similarities. The formal name for describing these compounds was “silicoketone,” which he shortened to silicone as he thought that the structure of the repeating unit was essentially that of a Ketone.



In the 1930s, a scientist from the company Corning Glass Works was trying to find a proper material to include in insulation for electrical parts. Silicone worked for the application due to its ability to solidify under heat. This first commercial development led silicone to be widely manufactured.

In 1940 American chemist Eugene George Rochow at the [General Electric Company](#) laboratories in Schenectady, N.Y., U.S., prepared methyl siloxanes by the process that remains the basis of modern polymerization methods. Meanwhile, researchers at Corning Glass were exploring the production of silicones, and in 1943 Corning and the [Dow Chemical Company](#) formed the Dow Corning Corporation to produce silicone products.