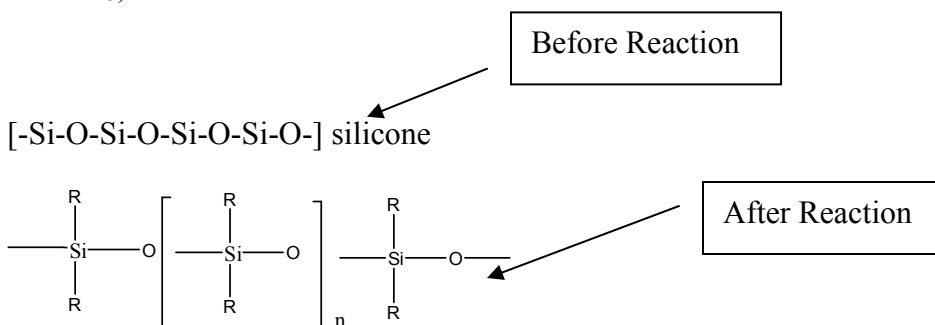


## SILICONE SUPER BALL TEACHER HANDOUT



Silicone polymers do not have carbon as part of the backbone structure. Although silicon is in the same group as carbon in the periodic table, it has quite different chemistry. Many silanes are known which are *analogous* (It might be a good idea to point out analogous means similar. Have students list some similarities and differences silicone has to alkane hydrocarbons) to the hydrocarbons with Si-Si bonds. These compounds are not very stable and hence not very useful. Silicones on the other hand have an alternating -Si-O- type structure. This basic structural unit is found in many rocks and minerals in nature including common sand. Various organic groups such as methyl or the benzene ring may be bonded to the silicon. (As an advanced study have students present the effect different substituents (groups) have in silicone) Silicones are characterized by wide-range thermal stability, high lubricity, extreme water repellence and physiochemical inertness (As a pre-lab activity, you may want students to explore the properties of silicone). Silicones have a number of medical applications because they are chemically *inert*. Their wide-ranging uses include adhesives, lubricants, protective coatings, paints, electrical insulation, synthetic rubber, and prosthetic replacements for body parts, including implants. Sodium silicate solution is produced by fusing sand ( $\text{SiO}_2$ )<sub>n</sub> and soda ash ( $\text{Na}_2\text{CO}_3$ ) in a furnace at about 1300°C. The final product,  $\text{Na}_2\text{O}(\text{SiO}_2)_n$  is also called water glass. The reaction with ethyl alcohol produces a superball which is most likely a silicone elastomer where the R is (-O-CH<sub>2</sub>CH<sub>3</sub>).



Silicones are water repellent, heat stable, and very resistant to chemical attack. They find many uses in oils, greases, and rubber-like materials. Silicone oils are very desirable since they do not decompose at high temperature and do not become viscous. Other silicones are used in hydraulic fluids, electrical insulators and moisture proofing agent in fabrics.

Material taken from the following sources:

<http://www.elmhurst.edu/~chm/vchembook/404silicone.html>

Flinn Scientific. Silicone Super Ball (1996).

Side Note: A good deal of controversy has involved the use of silicone in polyurethane bags as breast implants. Again they were used because they were thought to be very inert and resistant to dissolving or other reactions. Reports have cited increased cancer risk and severe immune responses from possible leakage of the silicone from the implants. Some scientists dispute these findings.

Answers :

1. Both are clear liquids that have generally low viscosities. Look water-like. Ethanol has a distinct smell.

2. The viscosity increases as the mixture thickens.

3. The final product is a highly cross-linked gel while the reactants are liquid solutions. Also oxygen gas may be a product. Students will see that the oxygen disappears when the ethyl group is added.

4. Examples would include the following: The Golden Gate Bridge, Spider Web.

Answers will vary.

5. This would be a chemical reaction. In a chemical reaction the end product is completely different from the substances that make it. (Ethanol and sodium silicate are both liquids while the final product is a gel.) Also cross-linking is a chemical process because new bonds are formed.