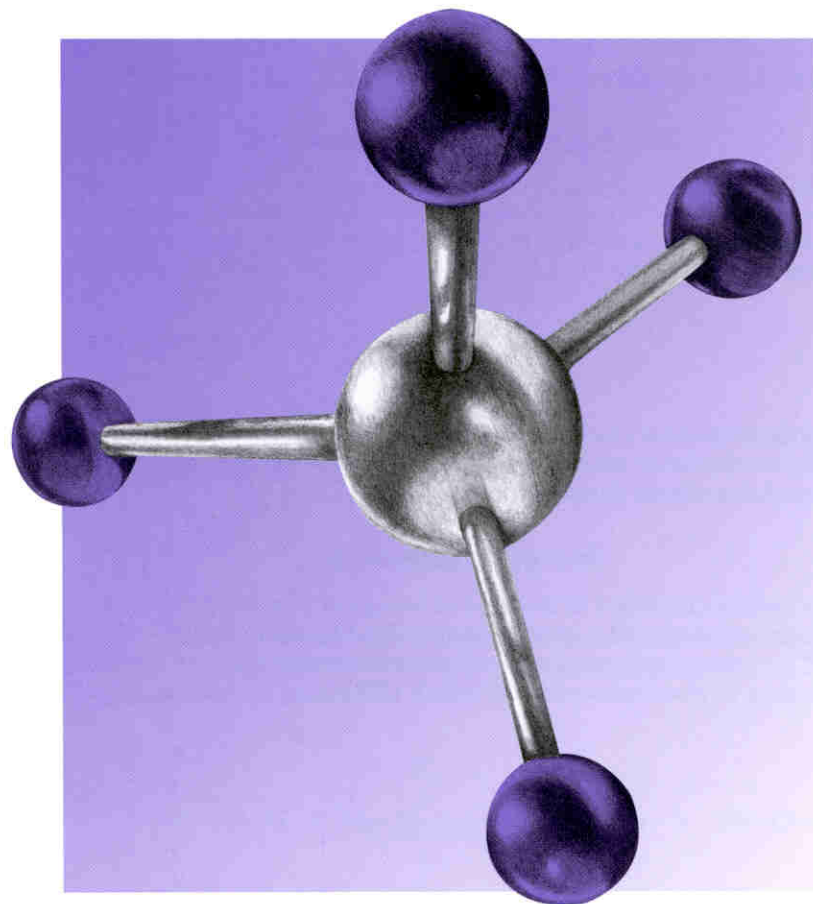


Silane Chemistry Primer



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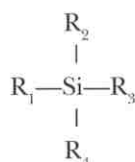
Founded in 1943 as a joint venture of The Dow Chemical Company and Corning Incorporated, Dow Corning Corporation has over a half-century of experience with silanes and silicones and is a world-leader in silicon chemistry. A diverse, high-technology company, Dow Corning develops and manufactures approximately 5,000 products, comprised of silanes, silicones, polycrystalline silicon and related specialty chemical materials. To help you better understand some of the products available from Dow Corning, this primer provides an introduction to silane chemistry, a basic building block of silicon chemistry.

Silicon Chemistry

Silicon is in the same group of the periodic table as carbon. Silicon will bond to four other atoms to give molecules that are structurally similar to carbon-based molecules. However, silicon is also significantly different from carbon in that it is more electropositive, does not form stable double bonds and is capable of many unique chemical reactions. As a result, silicon chemistry provides novel ways to modify organic molecules and create products that organic chemistry can't provide. Silicon-based materials include several types of valuable monomers and polymers. Common silicon-based polymers are named silicones; silicon-based monomers are named silanes.

Silanes: Silicon Monomers

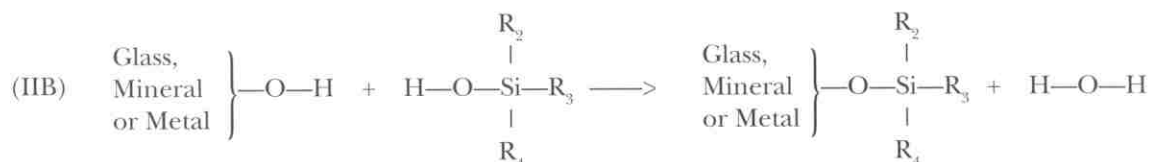
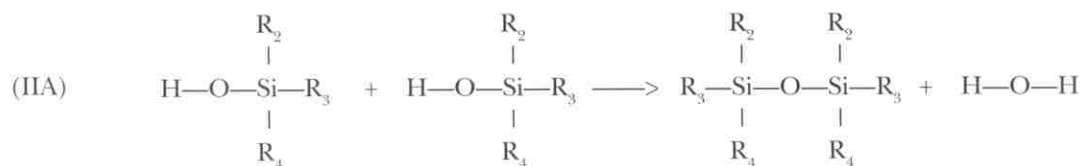
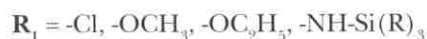
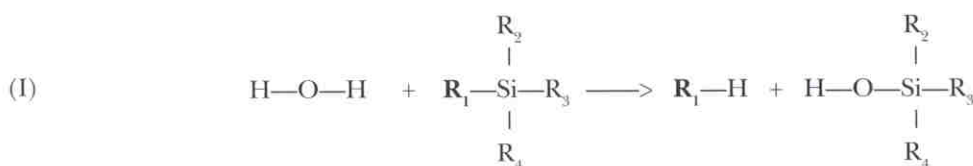
Silanes are a basic building block of silicon chemistry. A silane is a monomer with a chemical formula:



in which R_1 , R_2 , R_3 and R_4 represent the four chemical groups attached to the silicon atom. These groups can be the same or different. They can be *nonreactive* or *reactive*, with the reactivity being *inorganic* or *organic*. The large number of possible combinations partly explains silicon chemistry's versatility.

Inorganic Reactivity

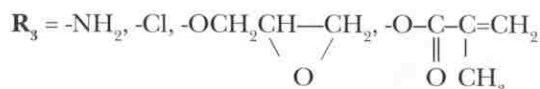
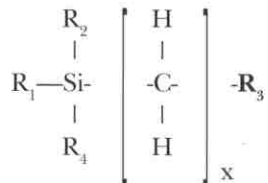
Silicon chemistry differs from carbon chemistry in the area of inorganic reactivity. When inorganic reactive groups such as chlorine, amine, methoxy or ethoxy (R_1) are directly attached to silicon atoms, they will hydrolyze in the presence of water (I), then self-condense to form a stable siloxane structure (IIA) or bond to hydroxyl groups on the surface of inorganic materials such as glass, minerals and metals (IIB).



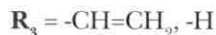
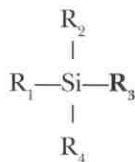
Organic Reactivity

A silane containing at least one carbon-silicon bond is known as an organosilane. The organic groups attached to the silicon atom can be either reactive or non-reactive.

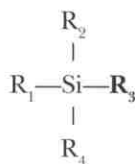
Specific organic reactivity can be built into a silane to match the reactivity of specific organic materials. Attaching organically reactive groups such as amino, chloro, epoxy or methacrylate (R_3) to silicon with an organic spacer like propyl ($x=3$) gives the molecule the potential to replicate organic reactions.



Some organically reactive silanes, particularly vinylsilanes and silicon hydrides do not have spacer groups. A hydrogen atom on silicon will easily add across a carbon-carbon double bond to form a very stable silicon-carbon bond. This can be useful for crosslinking or chain-extending reactions and allows the construction of a variety of chemical structures not easily achieved with normal carbon chemistry.



By adding organically nonreactive groups, such as methyl, higher alkyls (branched and straight chain), cycloalkyls, phenyl or trifluoropropyl, desirable characteristics such as hydrophobicity, organic compatibility, thermal stability and solvent resistance can be added to the silicon molecule.



Put Silane Chemistry to the Test

Silane chemistry combines familiar organic chemistry rules with silicon's unique inorganic properties. It offers many ways to improve the structure and performance of materials in industries such as automotive, chemicals, coatings, construction, electronics, pharmaceuticals, plastics and textiles. If you'd like to put silane chemistry to the test in your application, call Dow Corning Corporation at (517) 496-6000. We have over 50 years of silicon chemistry experience. We'll work with you to find silicon solutions to your application challenges.

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