

Silicone 101

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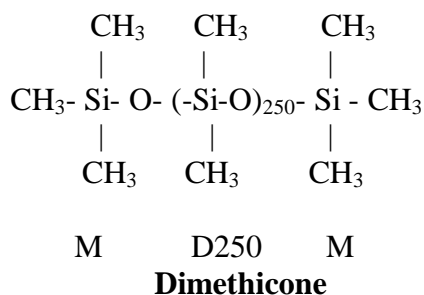
Anyone that has formulated with silicone compounds knows that this important class of compounds can be a bit problematic. Specifically, many formulators ask:

- § Why do silicone compounds fail to act in a predictable way in my formulation?
- § Why is there so much trial and error in using silicone compounds?
- § Why are compounds purporting to have the same INCI name act so differently?

The answer to the question is that the INCI name, while much more informative than in days gone by, does not provide all the information needed to fully understand functionality. The performance of a given silicone is dictated by three equally important factors:

- § Construction
- § Functionalization
- § Derivatization

- “**Construction**” relates to the make up of the silicone backbone and is related to the so called “M”, “M*”, “D”, “D*”, “T”, T* and “Q” components and how they are linked together. An example of a compound that has only construction is silicone fluid



- “**Functionalization**” relates to the functional groups that are present. They are generally a direct consequence of Si-H groups reacted with unsaturated groups in a process called “Hydrosilylation”. An example of a compound that has both construction and functionalization is PEG-8-dimethicone.

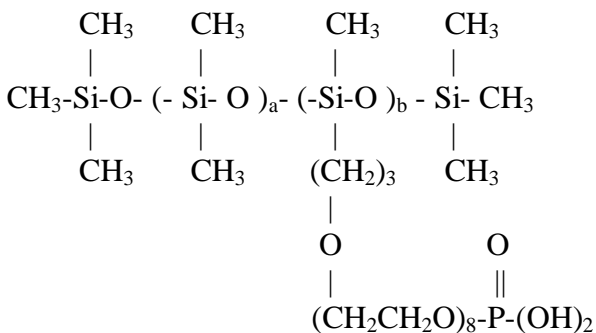
Examples of reactants with Si-H to organo-functionalize silicone are;

n Alkoxyated allyl alcohol $\text{CH}_2=\text{CH}-\text{CH}_2-\text{O}-(\text{EO})_a-\text{H}$
 Products PEG-dimethicone

n Alpha olefin $\text{CH}_2=\text{CH}- (\text{CF}_2)_n \text{CH}_3$
 Products Alkyl dimethicone

n Fluoro alpha olefin $\text{CH}_2=\text{CH}-\text{CH}_2- (\text{CF}_2)_n \text{CF}_3$
 Products Fluoro dimethicone

- “**Derivatization**” relates to the chemistries practiced on the groups added to the silicone backbone by functionalization. An example of a compound that has construction, functionalization and derivatization is PEG-8-dimethicone phosphate.



“Construction”, “Functionalization” and “Derivatization” dictate the properties of any silicone compound, but are rarely disclosed making proper selection of a product difficult.

The solution is to become a more demanding consumer. Ask questions, work with those that will educate you and keep learning! The possibilities offered to the formulation chemist by silicone chemistry is endless and yours to explore.