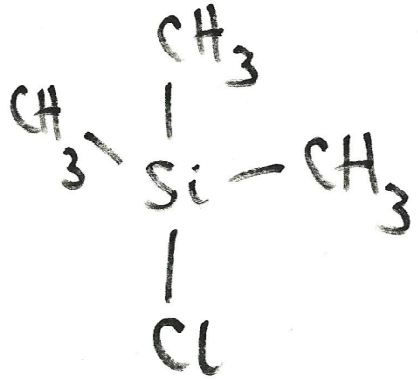
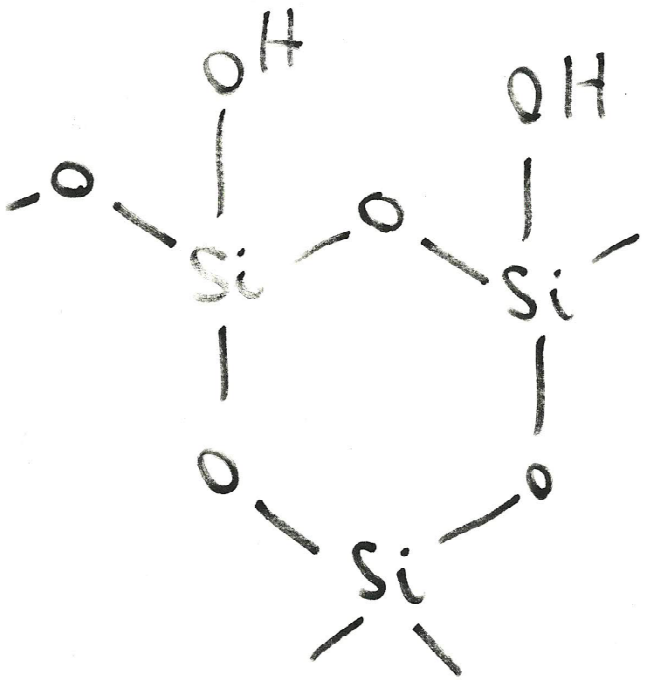
Silicones

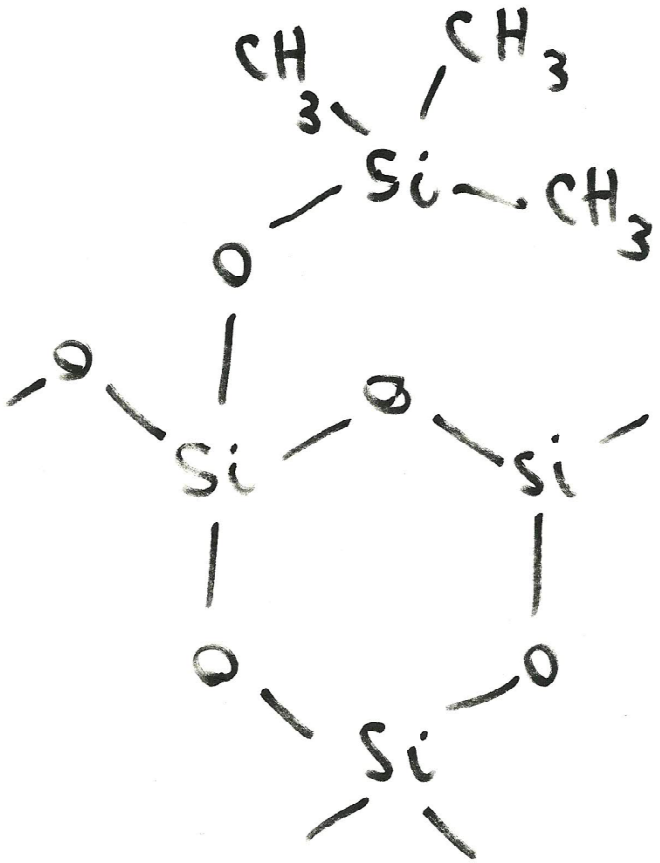
History

- WWII, US Military needed to minimise the fogging of optics in humid environments, eg periscopes in submarines and tanks.
- Treatment of lenses with the vapor of a silicon compound was effective.
- Instead of the glass surface being hydrophilic, it became hydrophobic.





Glass

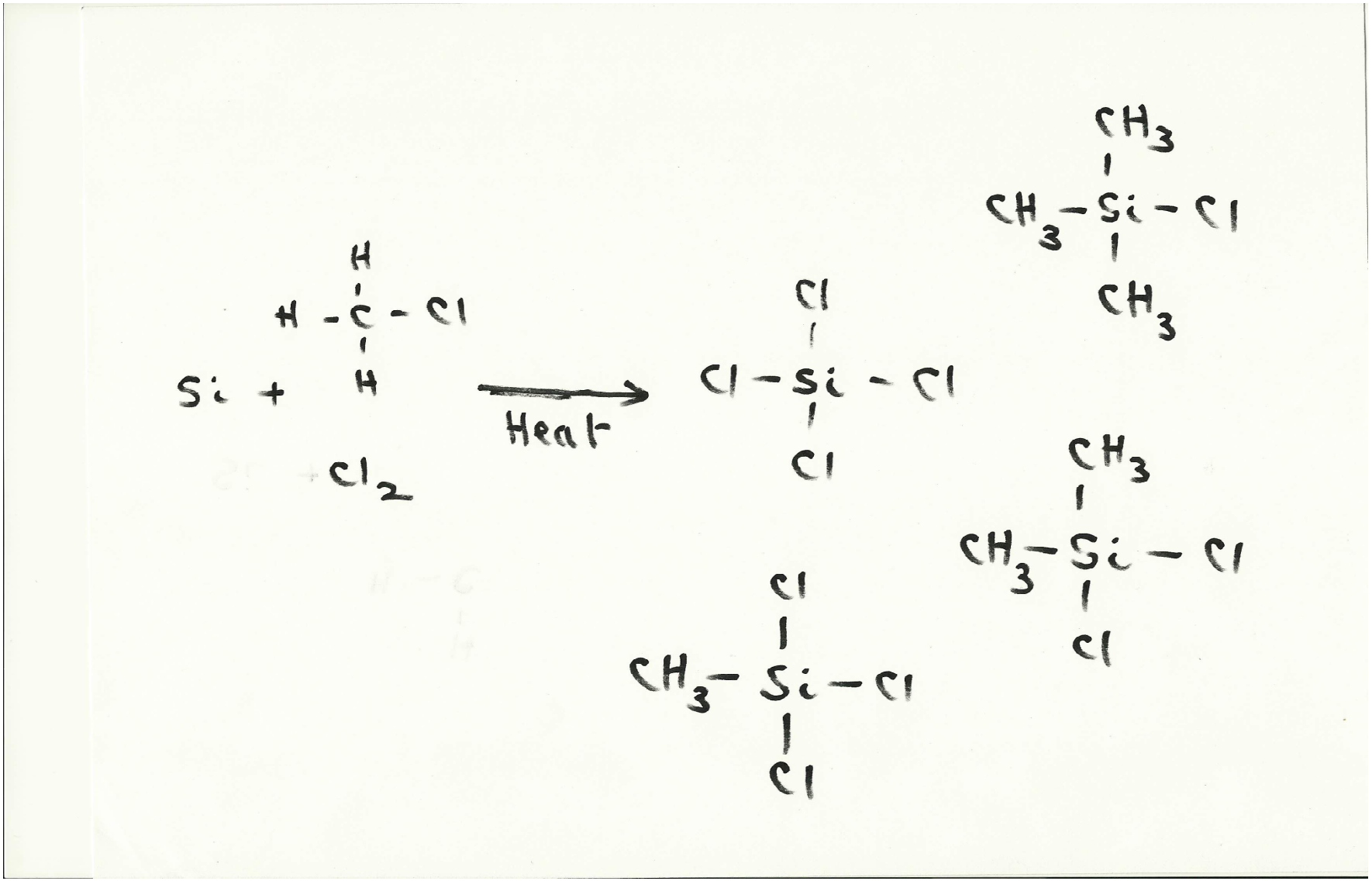


Treated surface

Key Properties

- Silane adheres strongly to glass (and all ceramics; pretty well to most metals too.)
- Very durable adhesion; unaffected by heat, moisture, UV.
- Extreme hydrophobicity.
- Negligible film thickness
- Nothing would stick to the treated glass.

Eugene Rochow's (GE) Process

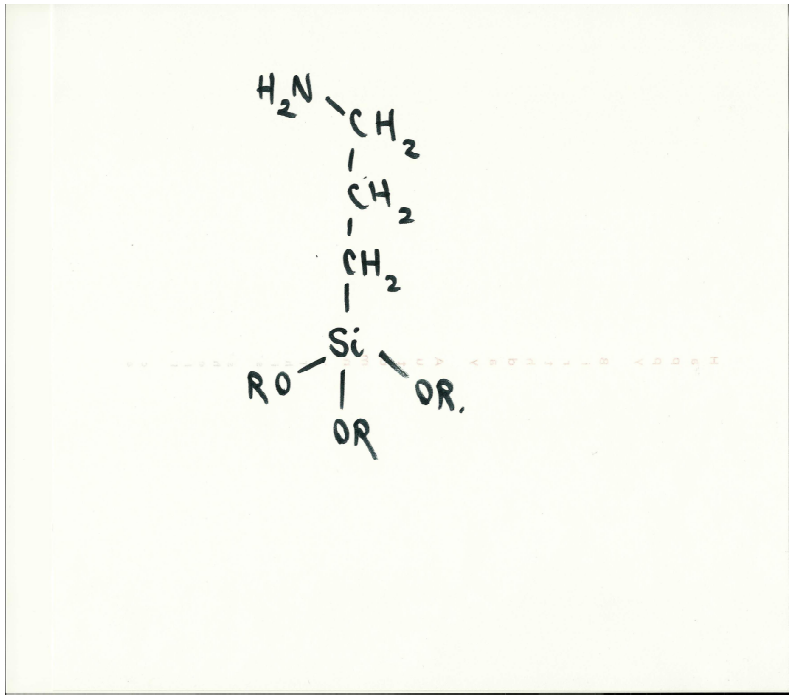


Useful Chemistry of Silicones

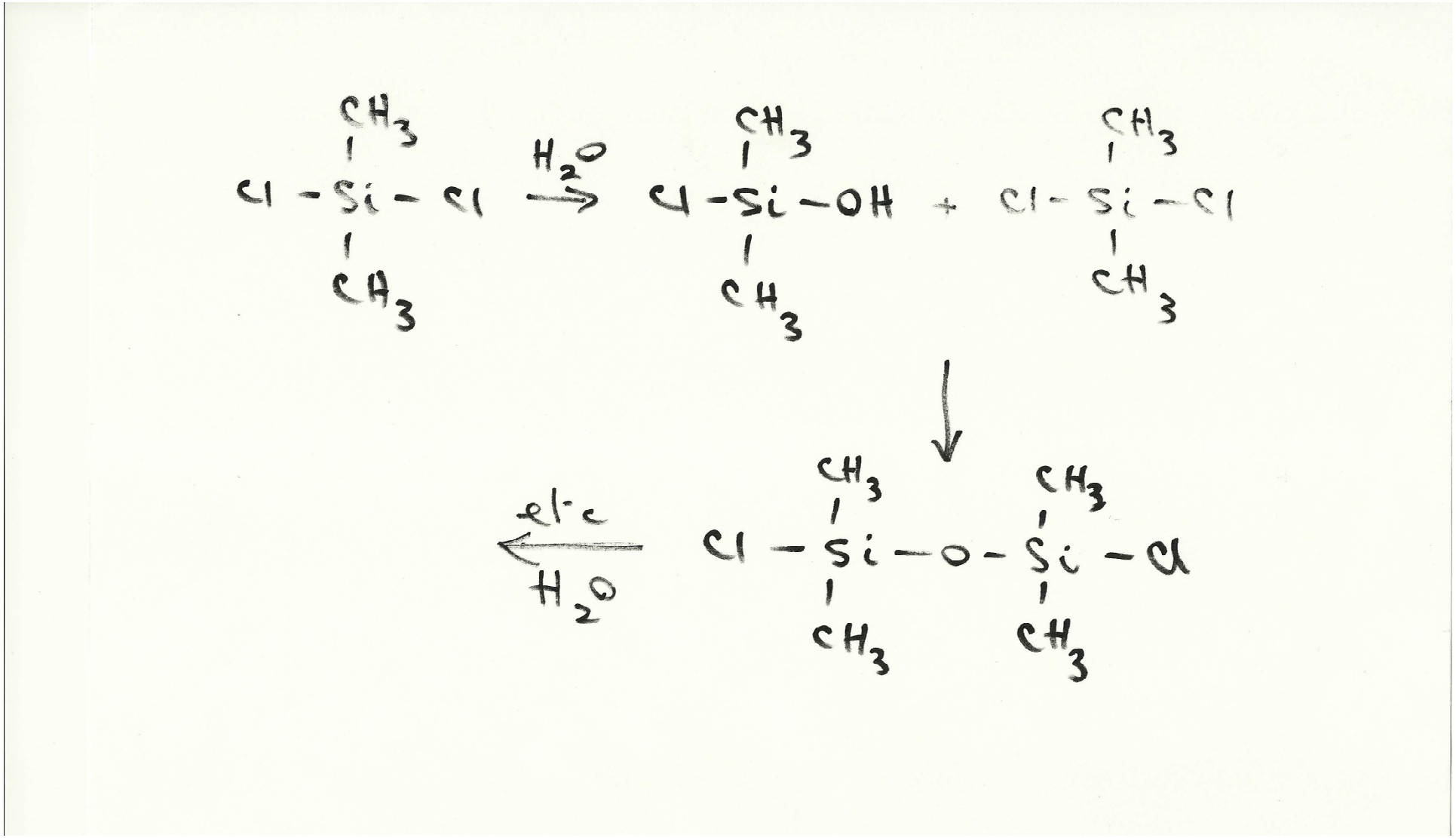
If the CH3 group is modified, the silane becomes an excellent adhesion promoter.

Has enabled glass fiber to be used as a reinforcement in boat hulls, storage tanks, rocket motors, tires, etc.

Very important commercially.



Polymerisation to Silicone Oil



Polymerisation to Silicone Oil

- When the polymerisation has proceeded to about 50 repeat units, product is an oil.

<u>Properties;</u>

- Very good heat resistance,
- Doesn’t yellow or degrade at 350^0C
- Doesn’t burn.
- Extremely hydrophobic.

Great Many Uses

- Effective in tiny amounts, and non-toxic.
- Silicone grease, high temperature heat transfer fluid, lubricant, defoaming agent, mold release, food additive, anti-caking agent, surfactant, indigestion aid (Dimethicone), etc.
- Component in: polishes, cosmetics, hair conditioner, skin moisturising formulations, water repellant coatings, Silly Putty, etc

Silicone with Reactive End Groups

Reacts further with moisture and becomes:

1. adhesive to glass and metal surfaces,
2. And polymerises to become a soft elastomer.

Useful as a bathroom sealant.

Excellent durable adhesion to ceramics and metals.

Works only in small cross-sections where moisture can diffuse in.

Using a Curative Mixed in:

For molds for casting larger complex shapes, and for faster cure:

- Dental impressions,
- Molds for furniture components or faux wood beams,
- Caulks and sealants, firestops.
- Gaskets and seals,
- For baking, spatulas, bread molds,
- Solvent and oil resistant hose.
- Encapsulant for electronics, eg pacemakers

Coatings Applications

- Release layer for adhesive tape and labels, postage stamps, Band-aids.
- Metal coating for non-stick bakeware.

An Impressive List of properties

- Soft and elastic; Tg is -127^{o}C
- Will not burn
- Hydrophobic and water repellant,
- Solvent and oil resistant
- Tolerated by the body if implanted.

- Said to be a tiny component of thousands of products we use every day, even Chicken McNuggets!