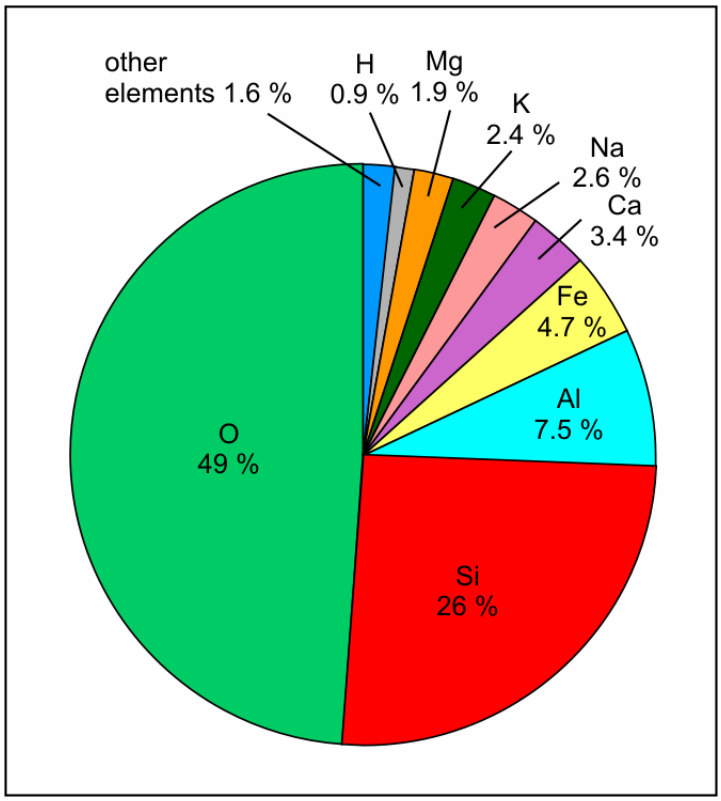
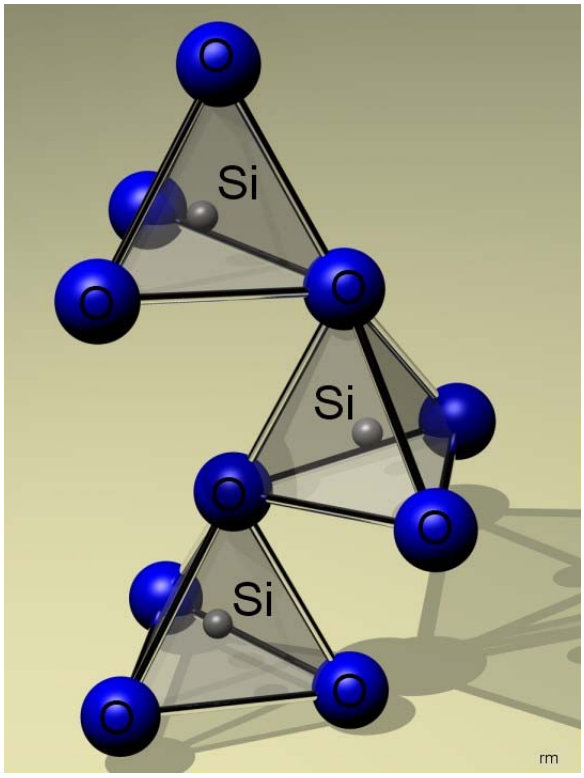
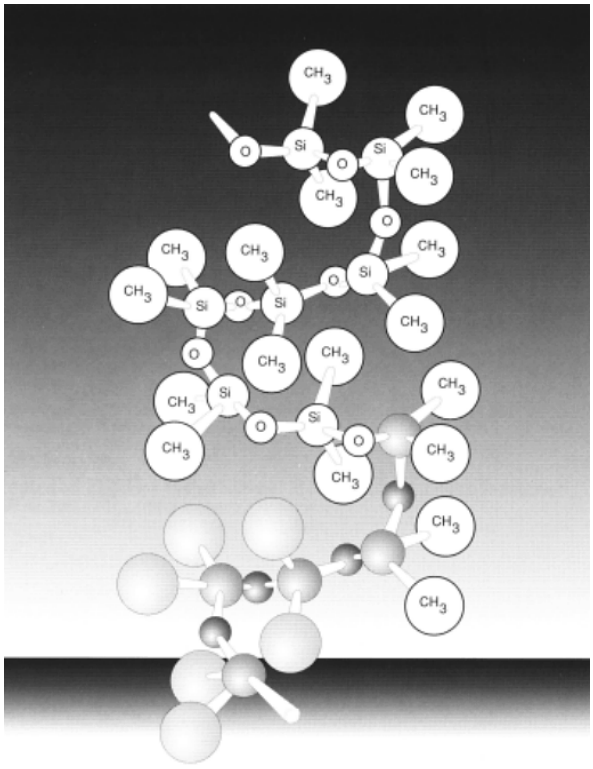
Quartz – silicon - silicone



Percentage distribution of the 10 most common elements in the earth's crust

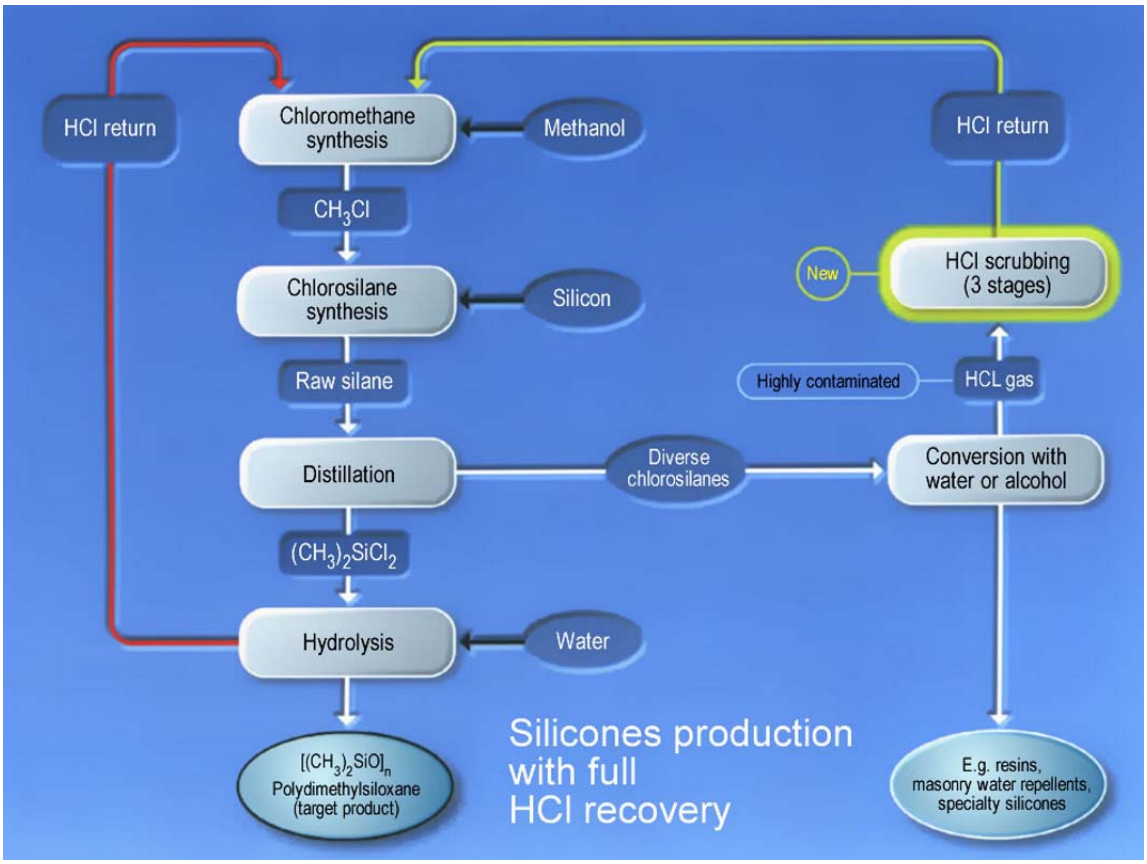


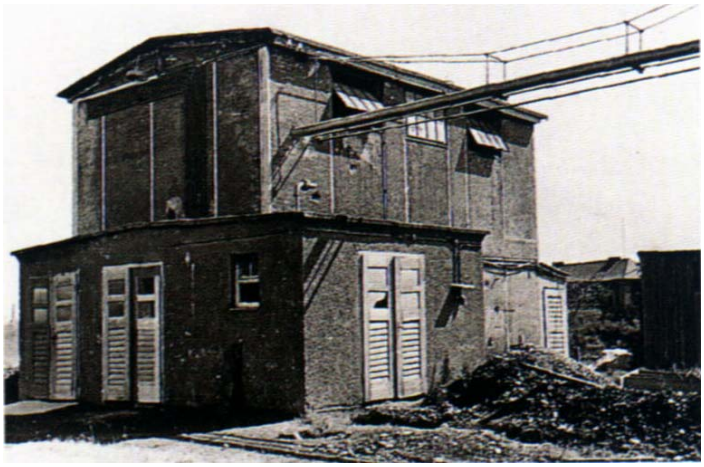
Structure of quartz



Model of a silicone molecule

Manufacture of chlorosilanes





First silicones production building of WACKER in Burghausen (1949)

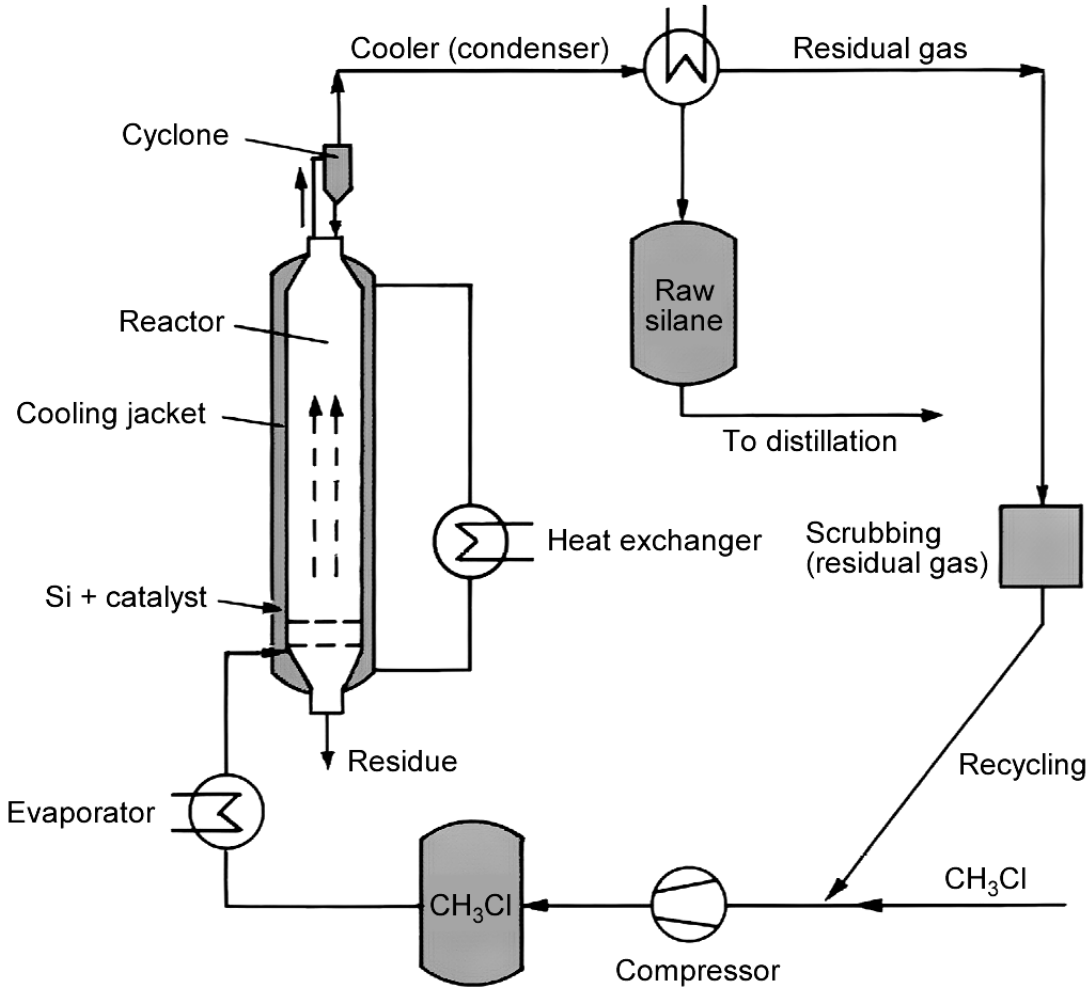
Silane distillation at WACKER's Burghausen plant (today)

Müller-Rochow synthesis/Slide 1

Basic reaction of the Müller-Rochow synthesis:

$$Si + 2\ CH_3Cl \xrightarrow{[Cu]} (H_3C)_2SiCl_2 \text{ and other Silanes}$$

Schematic diagram of the Müller-Rochow synthesis:

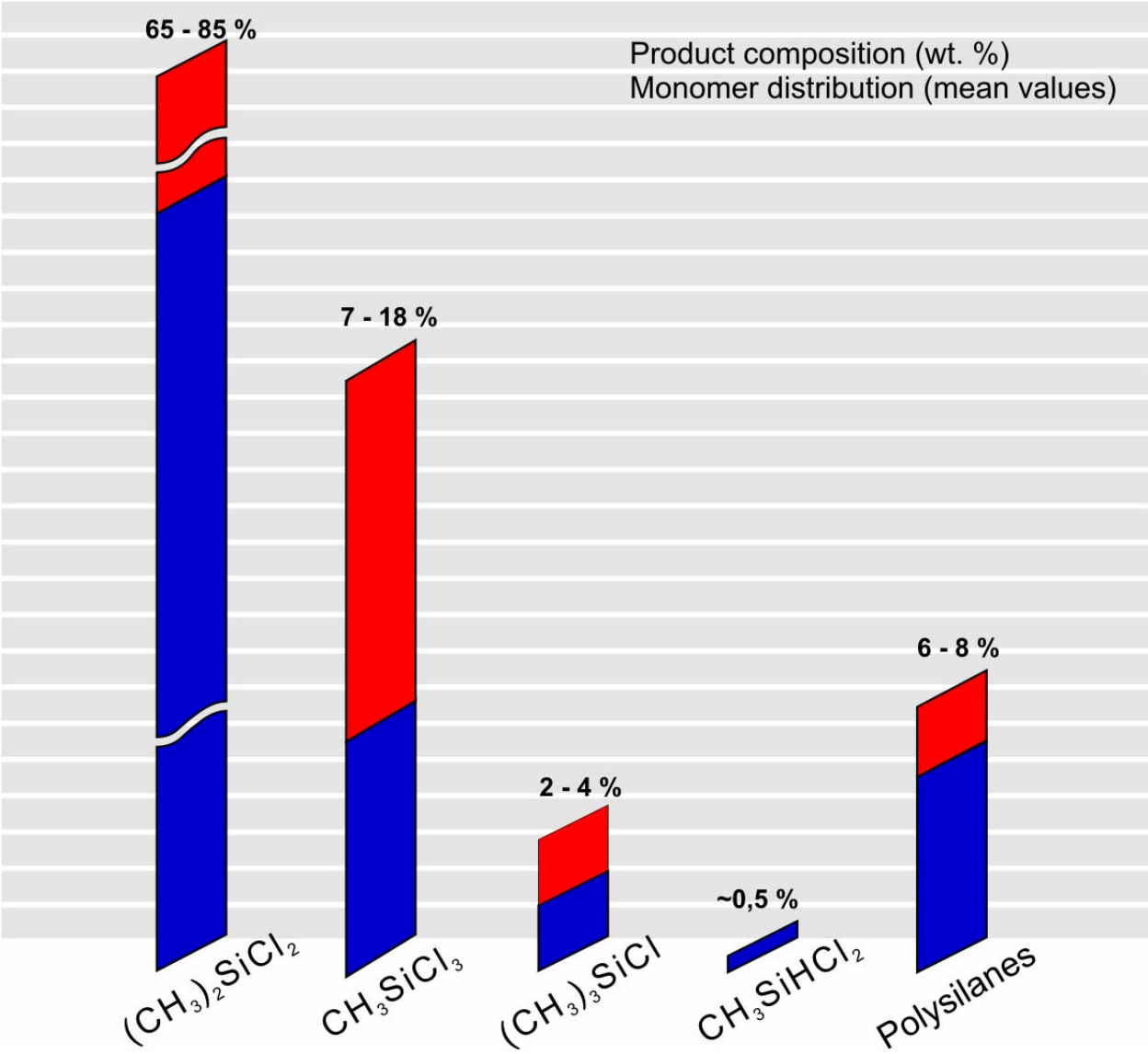


Müller-Rochow synthesis/Slide 2

Basic reaction of the Müller-Rochow synthesis:

$$Si + 2\ CH_3Cl \xrightarrow{[Cu]} (H_3C)_2SiCl_2 \text{ and other Silanes}$$

Product distribution in the Müller-Rochow synthesis:



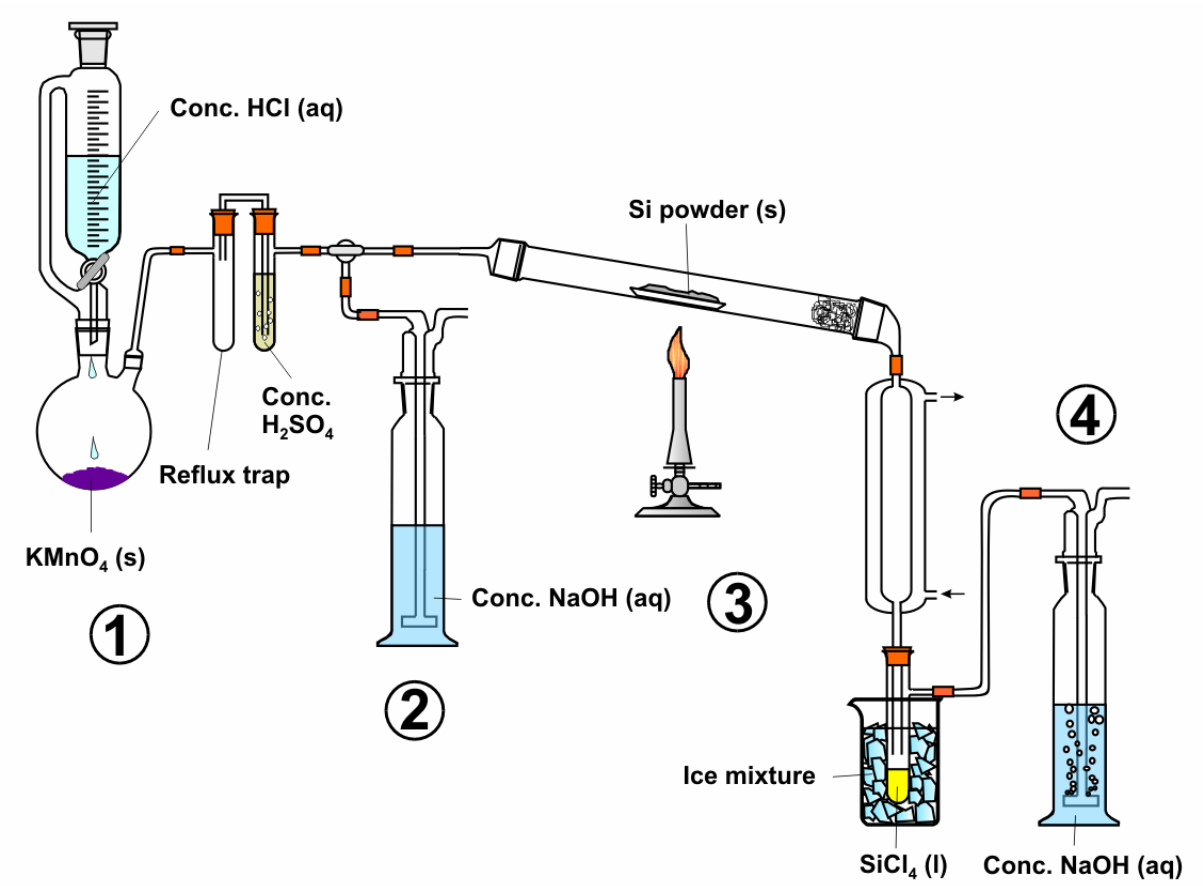
Synthesis of tetrachlorosilane

① **Manufacture and drying of chlorine**

$2\ KMnO_4\ (s) + 16\ HCl\ (aq) \rightarrow 5\ Cl_2\ (g) + 2\ MnCl_2\ (aq) + 2\ KCl\ (aq) + 8\ H_2O\ (l)$

③ **Synthesis and condensation of $SiCl_4$**

$Si\ (s) + 2\ Cl_2\ (g) \rightarrow SiCl_4\ (l)$



② **Absorption of chlorine before and after $SiCl_4$ synthesis**

④ **Absorption of excess chlorine**

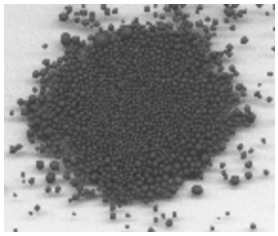
$Cl_2\ (g) + 2\ NaOH\ (aq) \rightarrow NaCl\ (aq) + NaOCl\ (aq) + H_2O\ (l)$

Introduction to silicones/Slide 1

1. Components of silicones:

Polycrystalline silicon chunk

Silicon (Si)



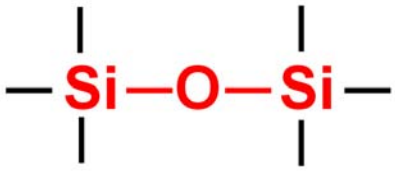
Solar-grade silicon particles

Oxygen (O_2)

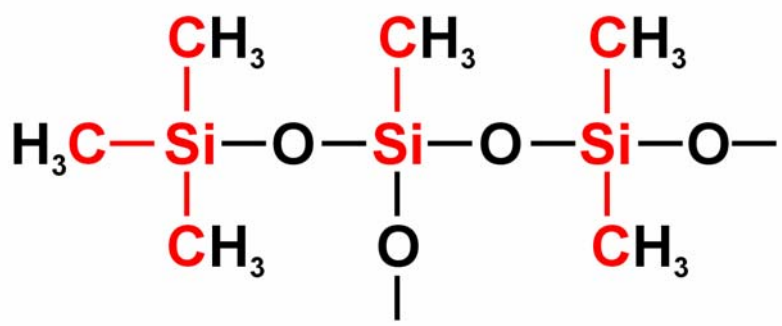
Organic groups (R)
[R: e.g. the methyl group -CH_3]

2. Chemical bonds:

a) a) The siloxane bond:



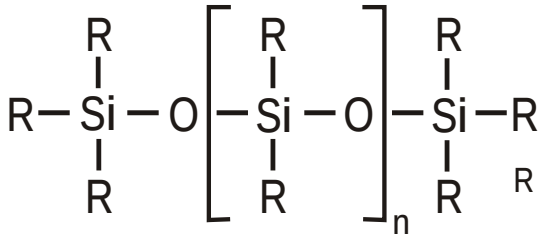
b) Silicon-carbon bonds:



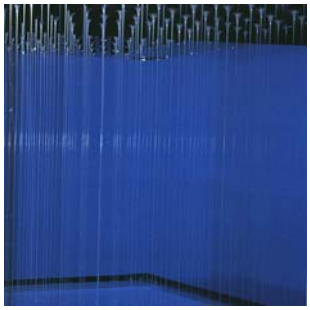
Introduction to silicones/Slide 2

3. The spatial dimension

a) Straight-chain molecules

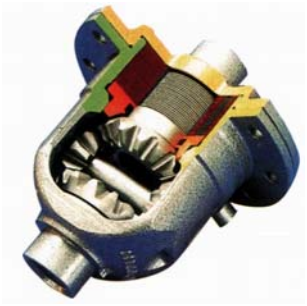


as basis of: Silicone fluids



In art

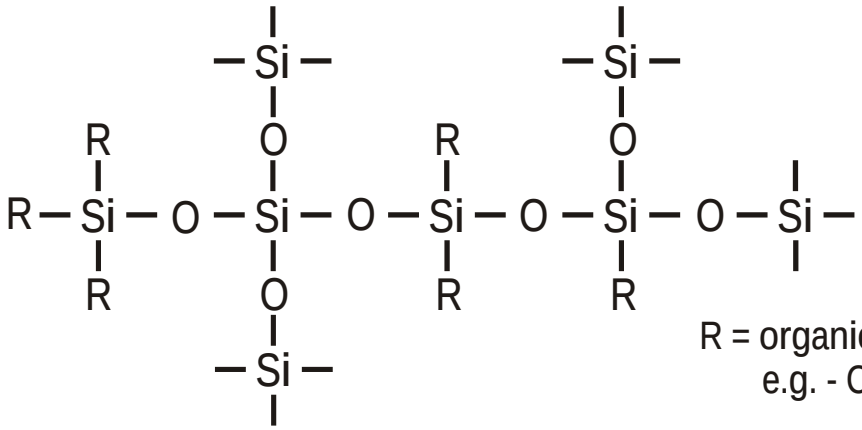
Fig.: Room installation by Miura (WACKER headquarters, Munich)



In engineering

Fig.: as filling for visco clutch in cars

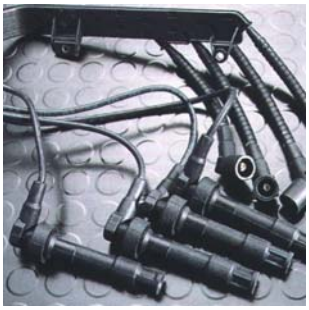
b) Crosslinked molecules



as basis of: Silicone resins and silicone rubbers

(extensively crosslinked) **(weakly crosslinked)**

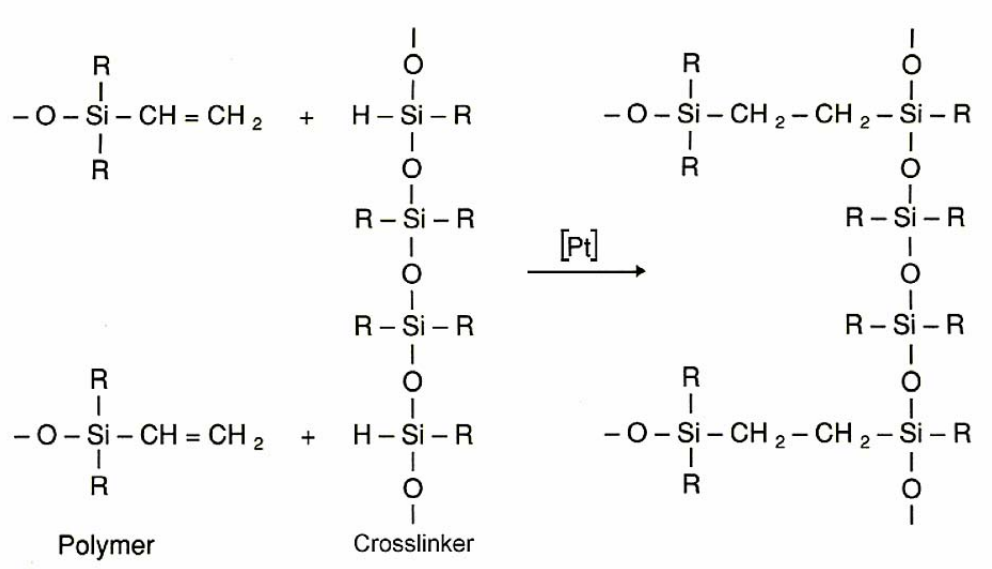
Silicone resin coating for the Kempinski hotel, Moscow



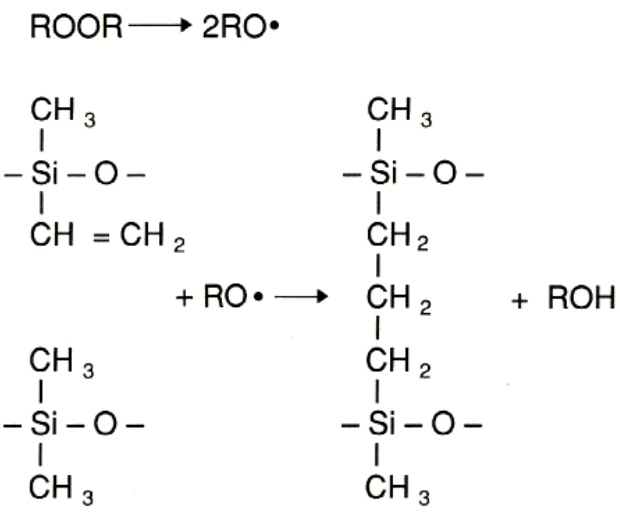
Silicone rubber seals and insulation in cars/Fig.: Ignition cables and spark-plug boots

Crosslinking reactions of silanes

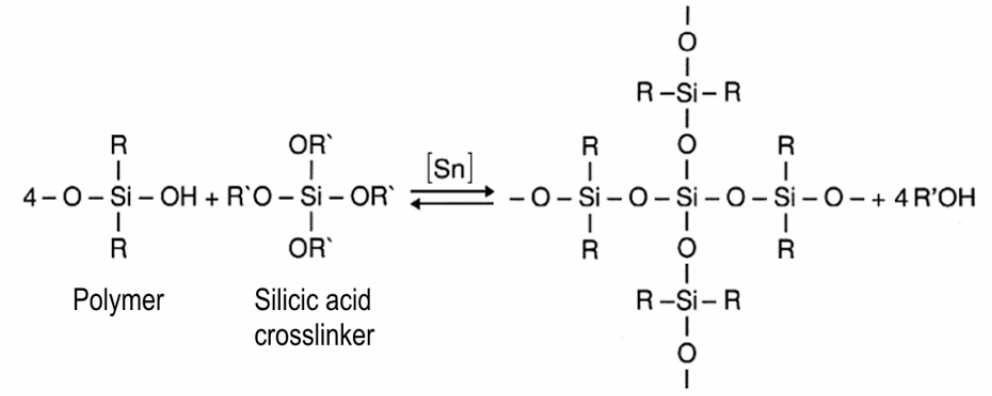
Addition curing



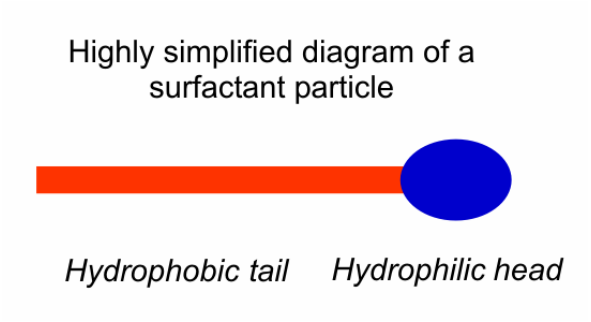
Peroxide curing (HTV rubber)

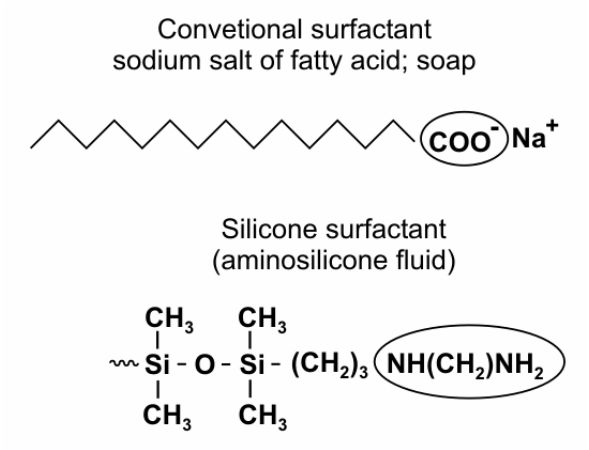


Condensation curing (RTV-2 rubber)

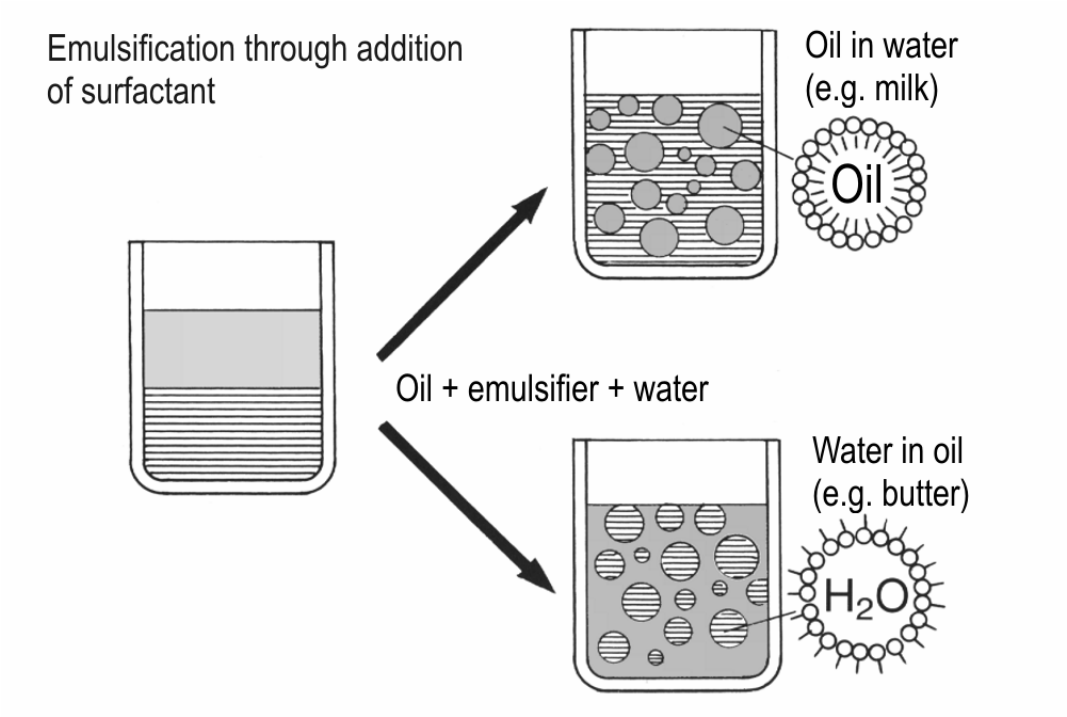


How silicone emulsions and antifoam agents work

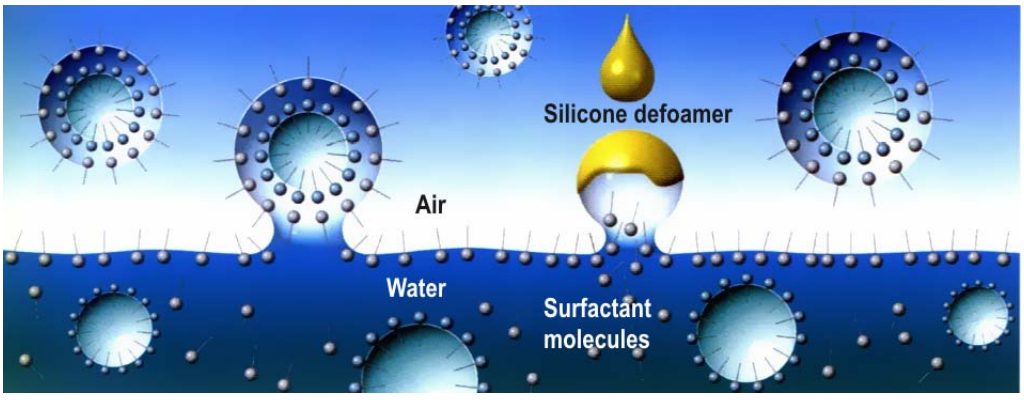




Two kinds of emulsion:



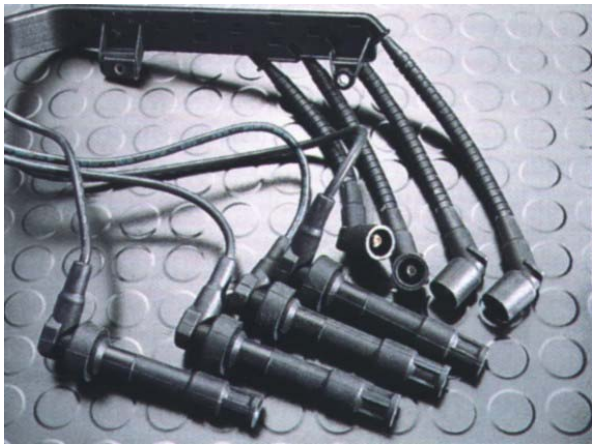
Bubbles and mechanism of a silicone antifoam:



Silicones in construction

1. **Additives for silicate paints**
2. **Joint-sealant tapes**
3. **Matrices for structural concrete**
4. **Impregnation of concrete**
5. **Paint primers**
6. **Sanitary joints**
7. **Impregnation of aerated concrete**
8. **Impregnation of facing bricks**
9. **Waterproofing gypsum**
10. **Profile seals**
11. **Connecting joints**
12. **Structural Glazing**
    (e.g. glass panels bonded to aluminum frame)
13. **Impregnation of roof tiles**
14. **Movement joints**
15. **Window seals**
16. **Jointing of natural stone**
17. **Impregnation of natural stone**
18. **Impregnation of lime-cement brick**
19. **Binders for silicone resin emulsion paints**
20. **Additives for mineral plasters**
21. **Chemical damp-proofing**

Silicones in vehicles



Silicone-jacketed spark-plug boots

Silicone-jacketed ignition cables

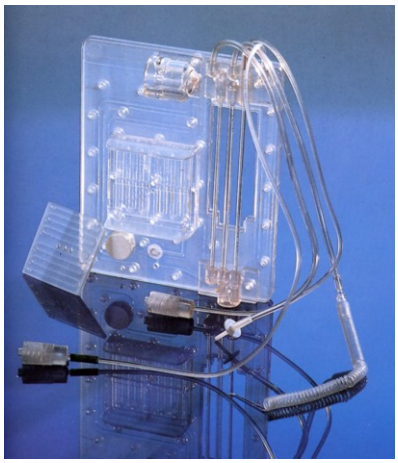
Electrically conducting silicone rubber ensures that noone gets stuck in a doorway

Inflated airbag

Silicone-coated fabric used in airbags

Silicones in medical engineering

Silicone rubber capsules ensure that the active ingredient is released in the right place.



The membranes and tubes of insulin pumps are made of silicone rubber.

Precision copies in dentistry; thanks to silicone rubber

Silicone rubber makes the tubes of this breathing mask flexible and durable.

Coating in the inside of legal bandages with silicones stops them from slipping.

Silicones for everyday use/leisure/textiles

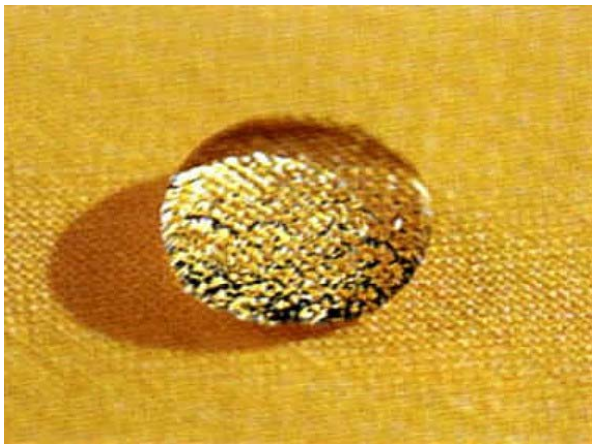
Dermatological tolerance and modern design; brought together in silicones

Weather-resistant and comfortable; silicones for uppers material

Silicones' resistance tosalt water and UV light prevent divers masks' from embrittling

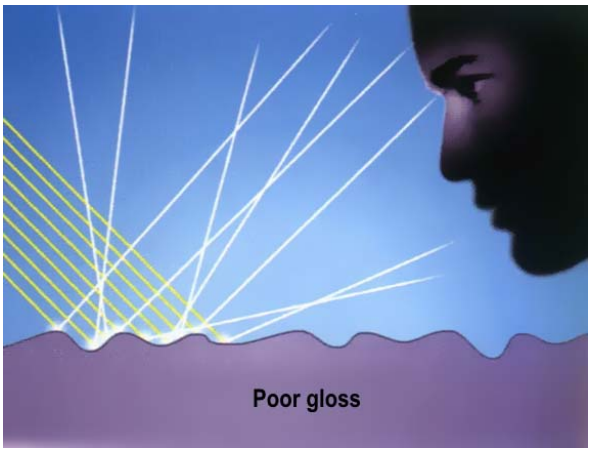
Fiberfill for anoraks; silicone emulsions help them resist laundering and dry cleaning

Silicone coatings are a match for extreme conditions

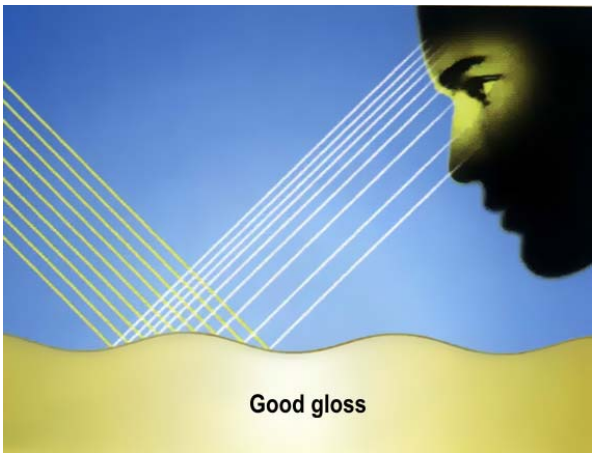


Textiles coated with silicones are water-repellent but still "breathe"

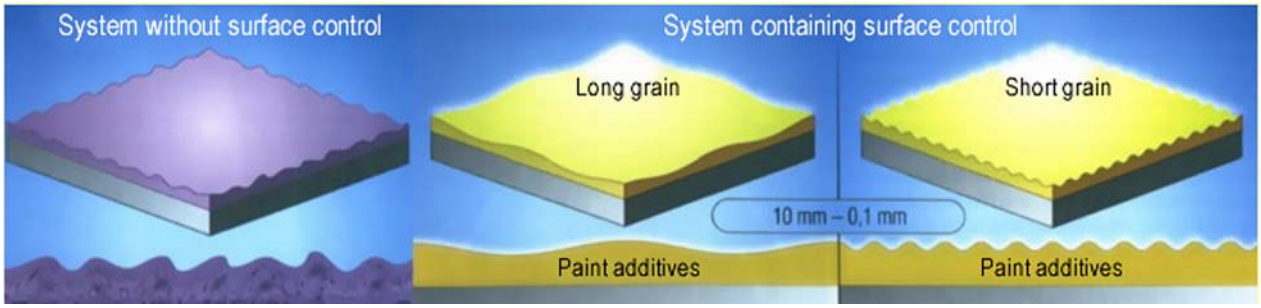
Silicones for paints



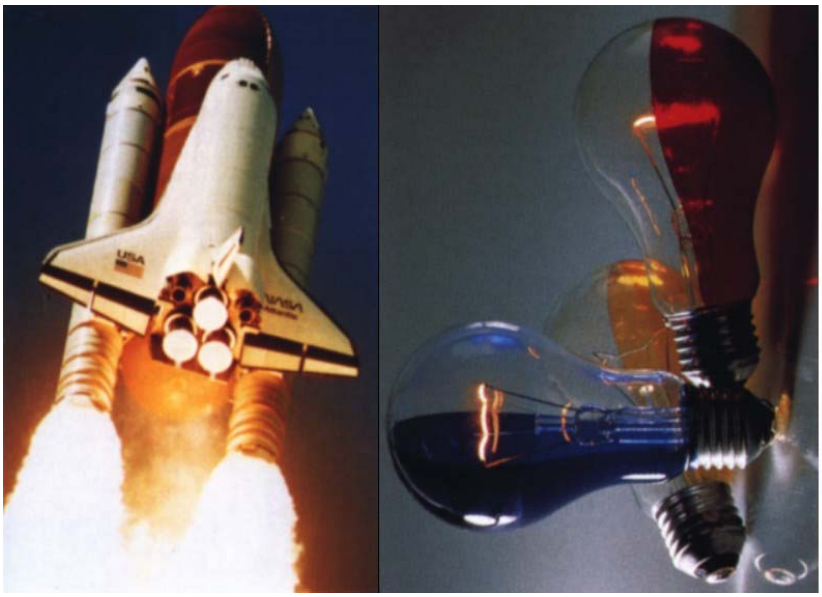
An uneven surface leads to poor gloss



An even, wavy surface leads to good gloss

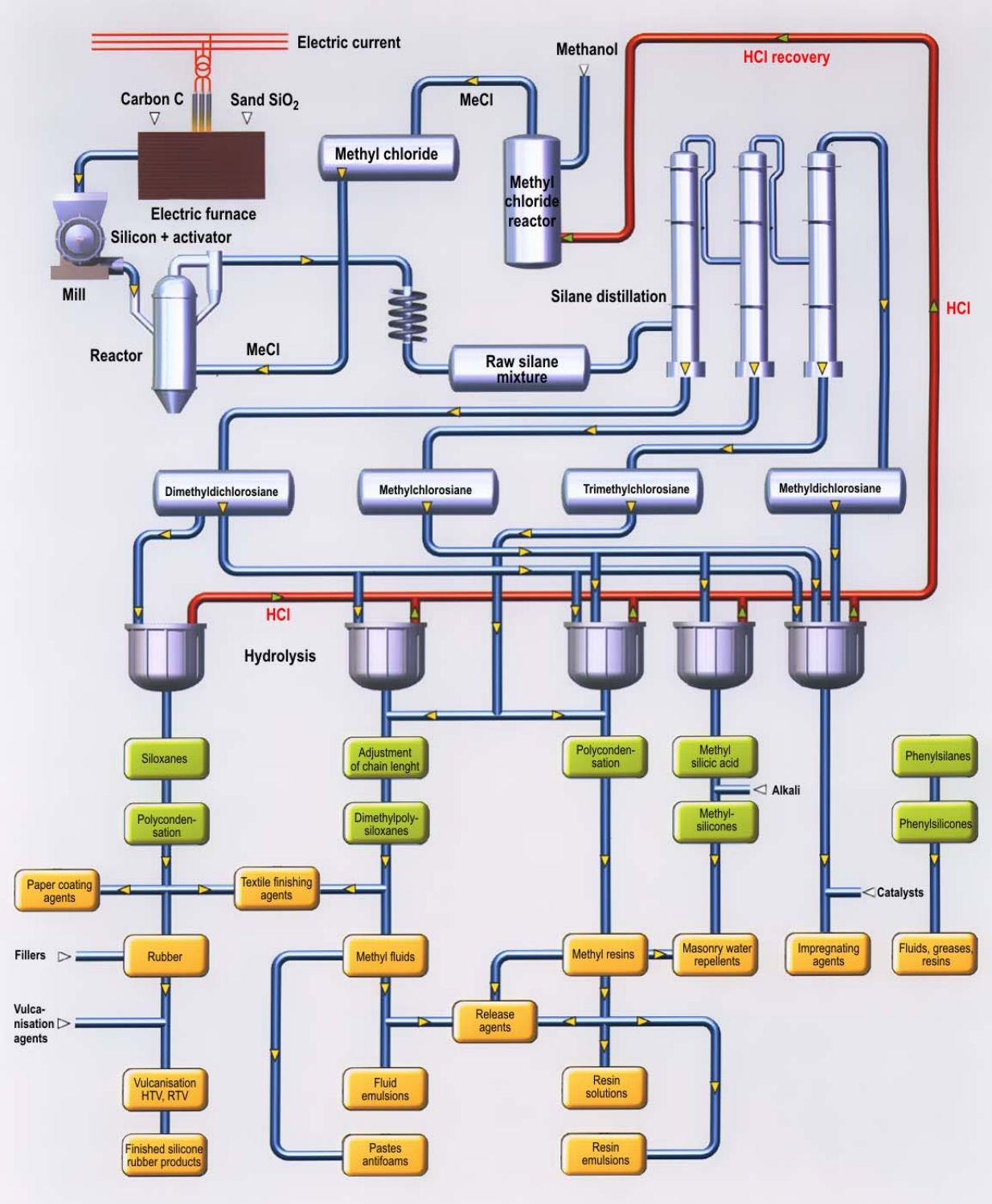


Silicone additives in coatings lead to an even surface and thus good gloss properties



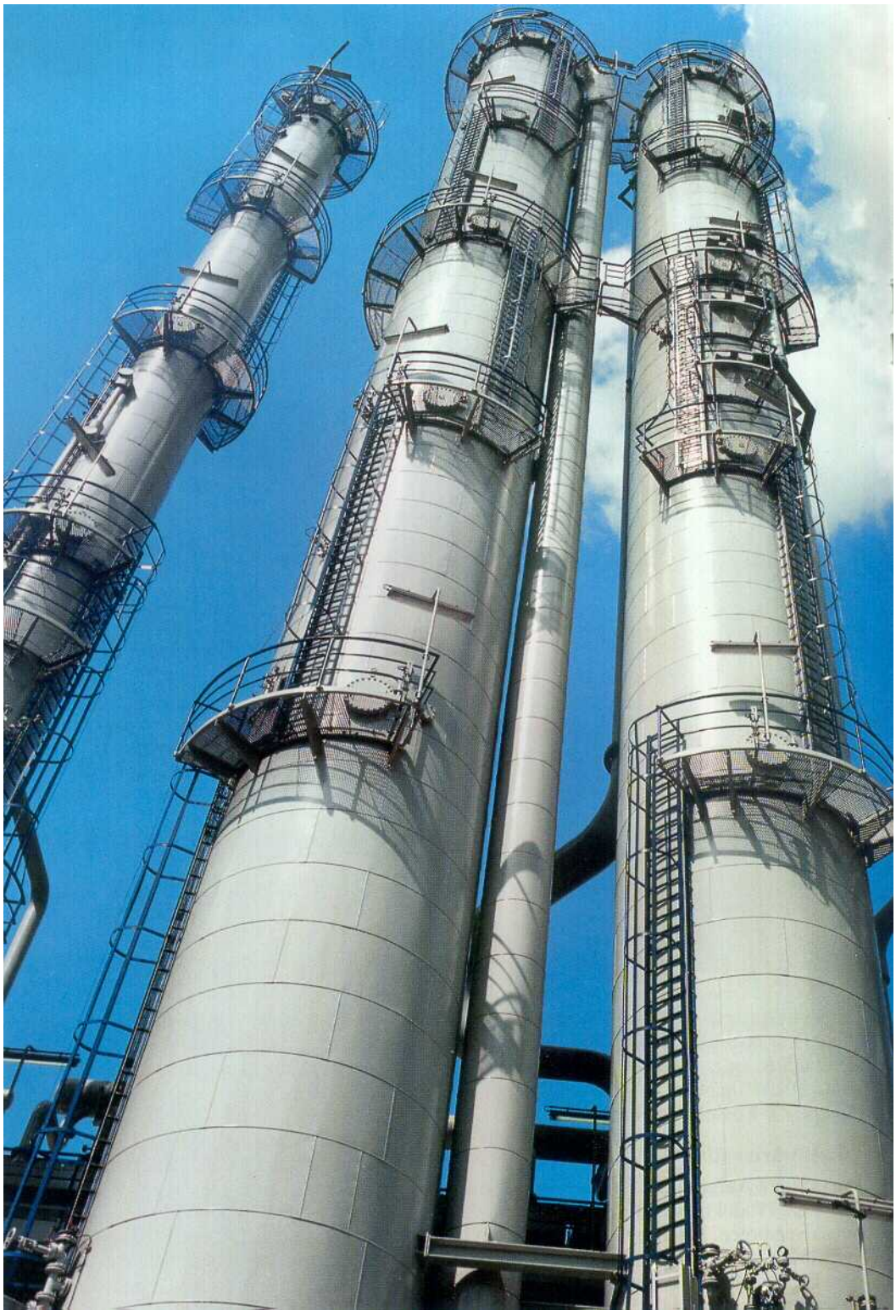
Three applications in which of silicone paints that have to withstand extreme thermal stress are shown here

Manufacture of WACKER silicones



Distillation columns

for the separation of chloromethylsilanes from the Müller-Rochow synthesis in WACKER's Burghausen plant

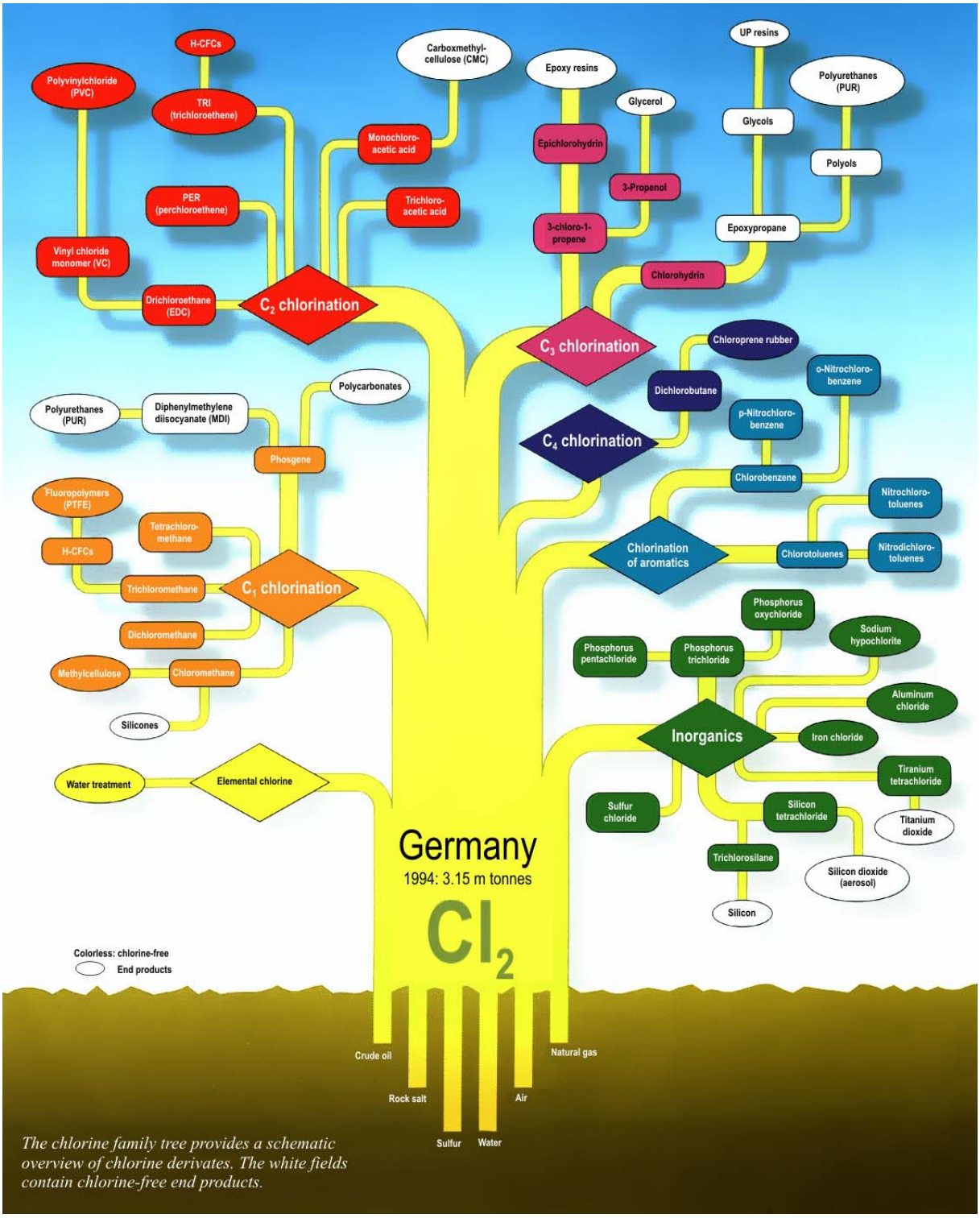


Closed material loops

in the production of silicones ensure cost-effective production and protect the environment

Section of the hydrogen chloride return facility used in the production of silicones at WACKER Burghausen

The chlorine family tree



All fields with a white background contain chlorine-free compounds. Silicones (see lower section of diagram) belong to the chlorine-free end products that are manufactured with the aid of chlorine and its compounds.

Glass dome of the German Reichstag building

Glass and metal are bonded together with silicones.

Cover picture of the schoolbook

"Chemie SII Stoff - Formel - Environment"

Fig.: WACKER silicones stop the foam