5.2.4.1.2 Wrought alloys

AlMgSi alloys (6xxx series) are widely used as medium-strength structural alloys. Typical silicon content is 0.5 to 1.0%.

The alloys of the 6xxx series have good hot-working properties and are age-hardening. These alloys are therefore well suited for extrusion of profiles, which by heating at 150 to 200°C are given their final strength.

The alloys present good corrosion and weldable properties. Typical markets are building and transport industries.

5.2.4.2 Applications in chemistry

5.2.4.2.1 Silicones

Since the discovery of the direct synthesis (reaction 5.1) of dimethyldichlorosilane, during the Second World War independently by Rochow and Müller, the silicones industry has developed to become a strong and growing chemical business consuming (year 2000) about 400 000 MT of silicon [8–11].

$$Si(s) + 2CH_3Cl(g) \rightarrow (CH_3)_2SiCl_2 \text{ (Cu catalyst, 260 to 370°C)} \quad (5.1)$$

$$(CH_3)_2SiCl_2 + 2H_2O \rightarrow (CH_3)_2Si(OH)_2 + 2HCl \quad (5.2)$$

$$n(CH_3)Si(OH)_2 \rightarrow [(CH_3)_2SiO]_n + nH_2O \quad (5.3)$$

The direct synthesis (5.1) is industrially performed in a fluidised bed reactor requesting small particles or powder of silicon (20–300 μm). The reaction is exothermic and needs to be activated with copper catalysts as well as promoters Zn, Sn, P and others. Whereas Fe does not seem to play an important role, Ca and Al have shown to take an active part in the overall reaction.

5.2.4.2.2 Synthetic silica

Varieties of synthetic silica such as pyrogenic silica (also called *fumed silica*) or silica ingots as feedstock to optical fibres are industrially prepared by burning silicon tetrachloride:

$$SiCl_4(g) + 2H_2(g) + O_2(g) \rightarrow SiO_2(s) + 4HCl(g) \quad (5.4)$$

Silicon tetrachloride may be prepared by chlorination of natural silica. However, industrially, silicon tetrachloride is produced by reacting chlorine with metallurgical grade silicon in a direct synthesis performed either in a fluidised bed or a fixed bed reactor:

$$Si(s) + 2Cl_2(g) \rightarrow SiCl_4(g) \quad (5.5)$$

$$Si(s) + 4HCl(g) \rightarrow SiCl_4(g) + 2H_2(g) \quad (5.6)$$

The present fumed silica market is about 100 000 to 120 000 MT, which in turn consumes around 50 000 to 60 000 MT of metallurgical silicon. It is noted that the main market for