silicon (commercially called *polysilicon*) with the adequate semiconductor properties is industrially prepared through the distillation and the thermal decomposition of volatile silicon compounds, for example, trichlorosilane, $SiHCl_3$, and monosilane, SiH_4. These operations are performed in large chemical plants, which for synergy reasons are sometimes incorporated in plants producing other silicon-based compounds as those described above. Although the ultimate application in the case of polysilicon is in the semiconductor industry, this particular process is, from a silicon raw material perspective, counted among the chemical applications of silicon.

The current production of polysilicon in 2000 was approximately 20 000 MT, whereas the installed worldwide capacity was estimated around 25 000 MT. Compared to the other applications of silicon, the use of semiconductor silicon in terms of volume is very modest. However, it is a high-value product. For example, the silicon value is multiplied by a factor of 30 to 50 through upgrading metallurgical grade silicon to polysilicon. This is also the fastest-growing application of silicon with an annual growth rate of approximately 10%, whereas silicones grows at a 5 to 7% rate, aluminium at 2 to 3% and silicon metal overall at 4%.

The present raw material for all silicon solar cells originates from this route. Therefore, a more detailed description of these processes will be given later in the present chapter.

5.2.4.4 Other applications

There are a few other applications of silicon in various fields such as explosives (silicon powder), refractories and advanced ceramics (silicon nitride and carbide). These applications presently do not account for more than 1% of the worldwide silicon metal output.

Because of their anticipated excellent mechanical and chemical resistant properties, alloys rich in silicon have a bright future. They may be prepared by powder metallurgy, mixing and sintering silicon powder with metallic powders (e.g. Cu, Al, Ti, Co, V etc.) [7].

The present chapter does not review the applications of silicon, such as glasses, ferroalloys and silicon carbide, in which silicon is usually added to the production process as natural silicate, quartz, quartzite or other silicon alloys.

5.3 PRODUCTION OF METALLURGICAL GRADE SILICON

5.3.1 The Carbothermic Reduction of Silica

Metallurgical grade silicon, also called *silicon metal*, with a typical purity of 98.5% Si is produced in submerged electric arc furnaces. In principle, this process is much the same as it was at the beginning of the twentieth (XX) century when it was first developed for ferrosilicon and other alloys. However, practical execution has greatly improved with larger furnaces, more efficient material handling and improved control of the operations. This has led to a continuous decrease of the specific energy consumption concomitant to higher degrees of raw material utilisation.