

3. decomposition to elemental silicon
4. recycling of by-products.

Many processes to produce polysilicon have been tested, patented and a few operated for many years. Only three large commercial processes are currently active:

1. The most popular process is based on the thermal decomposition of trichlorosilane at 1100°C on a heated silicon rod placed inside a deposition chamber. This process, which was developed in the late fifties, is commonly referred to as the Siemens process with reference to the company that carried out its early development.



In 2001 this process still accounted for at least 60% of the worldwide production of polysilicon.

2. In a more recent process developed by Union Carbide Chemicals in the United States of America, the trichlorosilane has been replaced by monosilane SiH_4 , but the principle of decomposition on a heated silicon rod inside a closed deposition chamber is maintained.



This process, presently run by the company *Advanced Silicon Materials, LLC*, has gained during the past 15 years a significant market acceptance.

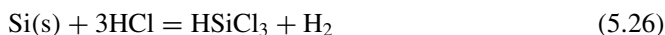
3. Finally, in the third process, also making use of monosilane SiH_4 , the heated silicon rod in the closed reaction chamber has been replaced by a fluidised bed of heated silicon particles. The particles act as seeds on which SiH_4 is continuously decomposed to larger granules of hyper-pure silicon. Unlike (1) and (2) this process is a continuous one. This process is known as the Ethyl Corporation process, after the name of the US chemical company that developed it. This process is presently run by the US corporation MEMC in Pasadena, Texas.

The respective features, advantages and disadvantages of these different routes are described in the following sections.

5.4.1 The Siemens Process

A schematic overview of the process is given in Figure 5.2.

Trichlorosilane HSiCl_3 is prepared by hydrochlorination of metallurgical grade silicon in a fluidised bed reactor:



This reaction occurs at 350°C normally without a catalyst. A competing reaction is

