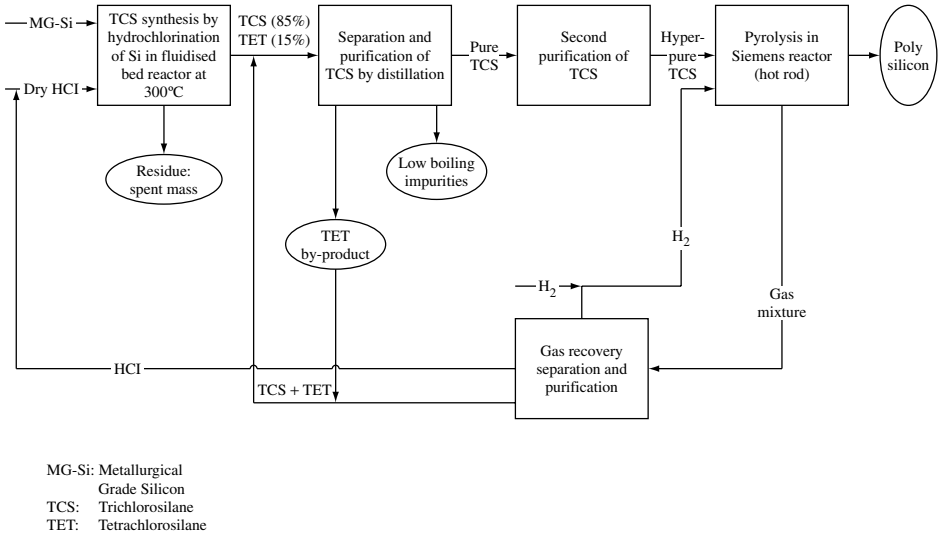

Figure 5.2 Schematic representation of the Siemens process

contributing to the formation of unsuitable tetrachlorosilane in molar proportion of 10 to 20%.

Trichlorosilane is chosen because of its high deposition rate, its low boiling point (31.8°C) and its comparatively high volatility and hence the ease of purification with respect to boron and phosphorus down to the ppb level. The boiling point of other silanes frequently found with trichlorosilane are as follows: SiH_4 (−112°C), SiH_2Cl_2 (8.6°C) and $SiCl_4$ (57.6°C). The suitable trichlorosilane undergoes a double purification through fractional distillation, the first step removing the heaviest components resulting from the direct synthesis and the second step eliminating the components lighter than trichlorosilane, also called *volatiles*.

High-purity $SiHCl_3$ is then vaporised, diluted with high-purity hydrogen and introduced into the deposition reactors. The gas is decomposed onto the surface of heated silicon seed rods, electrically heated to about 1100°C, growing large rods of hyperpure silicon.

The main reactions are:

$$2SiHCl_3 = SiH_2Cl_2 + SiCl_4 \tag{5.28}$$

$$SiH_2Cl_2 = Si + 2HCl \tag{5.29}$$

$$H_2 + HSiCl_3 = Si + 3HCl \tag{5.30}$$

$$HCl + HSiCl_3 = SiCl_4 + H_2 \tag{5.31}$$

The stream of reaction by-products, which leaves the reactor, contains H_2, HCl, $HSiCl_3$, $SiCl_4$ and H_2SiCl_2.