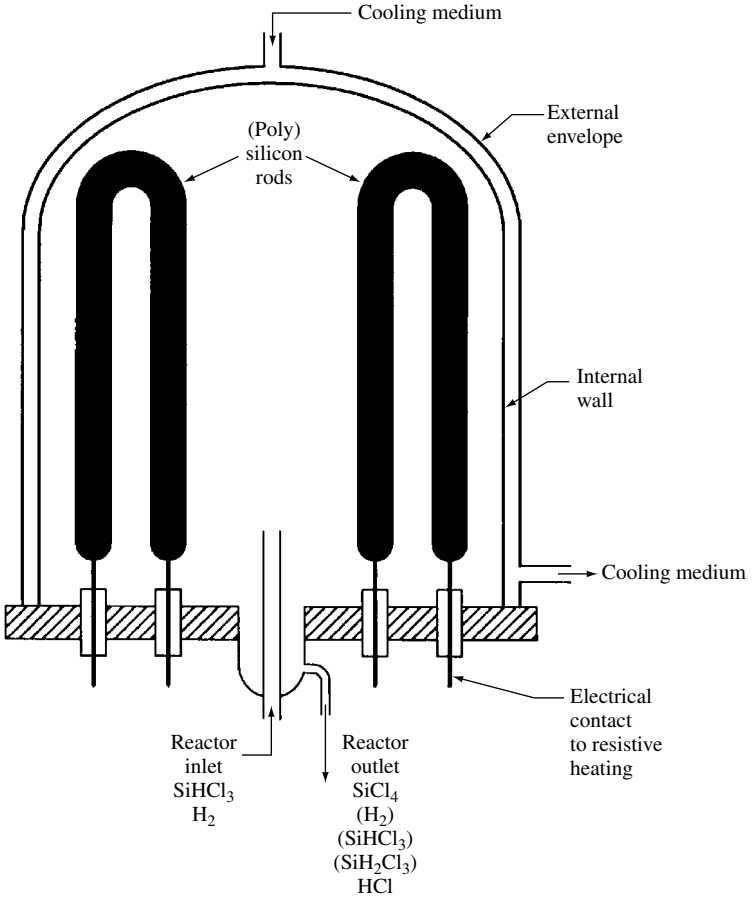

Figure 5.3 Schematic representation of the traditional Siemens reactor

A schematic representation of the Siemens reactor is given in Figure 5.3.

The Siemens process is highly energy consuming, a major part of the energy being dispersed and lost. To avoid deposition on the inner surfaces of the reaction chamber, this has to be cooled. Originally, the decomposition chamber consisted of a quartz bell jar containing one single inverted U-shaped silicon seed rod. A major advancement in polysilicon production was the utilisation of metal bell jars in place of the quartz bell jars. Quartz bell jars could not be produced in large diameters and were susceptible to breakage. The development of steel bell jars made it possible to accommodate 30 or more inverted U-rods in each reactor. This dramatically increased the productivity while decreasing the energy consumption per kilogram of produced polysilicon.

As reactions and equilibria (5.28) to (5.31) show, the deposition process generates by-products. Unfortunately, for each mole of Si converted to polysilicon, 3 to 4 moles are converted to $SiCl_4$, binding large amounts of chlorine and valuable silicon. The main industrial application of tetrachlorosilane is as a source material to produce pyrogenic (also called *fumed*) silica as described above in this chapter. The present market of fumed