To search page

First half of 1960's
Horizontal Diffusion Furnace
~ Equipment & Materials Table of Contents ~

Silicon thermal oxidation and gas phase diffusion, which are the basis of planar technology, were developed in Bell telephone Laboratories in the 1950s, and horizontal diffusion furnaces were used. In the 1950s, semiconductor device makers built diffusion furnaces by themselves and made transistors. Generally, a heater such as SiC and a thermocouple are inserted into the quartz tube and the heating of the wafers were controlled, and process gases were introduced by a needle valve.

In 1960, Lindberg released a horizontal type diffusion furnace of hot wall type, which were equipped with a Kovar (Fe-Ni-Co alloy) heater and a thermocouple outside of the quartz tube furnace body. The quart tube and the wafers on the boat were heated in a controlled temperature arrange of ± 5 ° C. It was equipped with a controller for automatic temperature control. Kokusai Electric (later Hitachi Kokusai Electric, now KOKUSAI ELECTRIC) developed and domestically produced a hot wall type horizontal diffusion furnace (DD - 1) in collaboration with Hitachi and started to sell them in 1963 (Figure 1).

Kanthal wire of Fe-Cr-Al alloy was used for the heater. In 1964, Thermco Systems which spun out from Lindberg started to sell them, and the hot wall type horizontal diffusion furnaces became popular as standard equipment for oxidation, diffusion and annealing of semiconductors. In 1968, Tokyo Electron established Tel/Thermco in an alliance with Thermco and started domestic production. In the latter half of the 1960's, furnace bodies were double stacked to improve productivity, and a structure in which a clean bench was provided in the wafer transfer section to enhance cleanliness became common (Fig. 2). In the 1980s, Themco (including Tel/Thermco) and Kokusai Electric gained a global share of nearly 70% between them in horizontal diffusion furnaces.

With the widespread use of hot wall type horizontal diffusion furnaces, quartz became one of the essential materials for the semiconductor industry. In Japan, material companies such as Nippon Quartz, Shin-Etsu Chemical, Asahi Glass, etc. synthesized semiconductor-grade quartz and sold quartz reaction tubes and quartz boats for wafer mounting, including maintenance parts. Other essential parts such as valves (Fujikin etc.) and gas flowmeters (Tokyo Keiso etc.) were also sold, and the supply chain was established.

Figure 1 Horizontal Diffusion Furnace (DD-1)
(provided by Kokusai Electric Corporation)

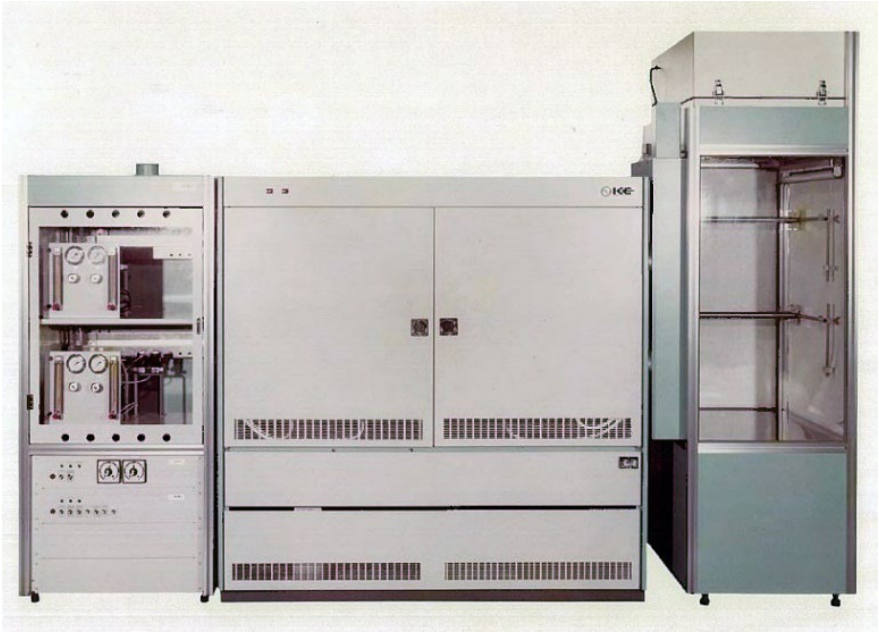

Figure 2 Multi-stage Horizontal Diffusion Furnace (DD-8200)
(provided by Kokusai Electric Corporation)