C-1

Growth Technology of Semiconductor Materials

Power electronics technology is in high demand, e.g., for portable information devices, power source, and inverters. In particular, in recent years, areas of application are expanding and increases in applications to electric-powered vehicles, and infrastructure including home appliances are expected. Along with the expansion of application fields, high-performance properties are also expected. Previously, power semiconductor devices using Si and GaAs series were predominant, however, the performance limits of materials per se were coming to a end. Accordingly, expectations for SiC, wide-gap semiconductors having properties of high-voltage, low loss and high-speed motion, increased. However, the growth of crystals of high quality still remained unsolved, so there were some difficulties for application to device process technology. From the beginning of the 1970s, H. Matsunami and T. Kimoto were the first to work on the improvement of SiC crystal techniques as a basic study for next generation electronic devices and in 1987 they succeeded in the development of the growth method of high quality liquid-crystal epitaxial focused on surface steps. In addition, they established the impurity doping method, and thus found intrinsic physical properties of SiC and paved the way for application to devices. Also, their findings made it possible to realize high-performance devices, e.g., high-voltage/high-speed shot-key diodes, high-voltage pin diodes and MOSFET. These pioneering achievements were globally recognized and considerably contributed to the development of applied devices. SiC semiconductors already contributed to significant downsizing, e.g., inverters for vehicles, and this is now a key device for the next generation, and is highly appreciated as a great achievement brought about by this breakthrough.

C-2

Development of Ultra-clean Chemical Technology and Next-generation Semiconductor Production Technology

One element of technology infrastructure that has supported prosperity in the semiconductor industry in Japan was the establishment of high-performance semiconductor production process technology which enabled the improvement of the performance/yield ratio of very-large-scale integrated circuits (VLSI). It was a big breakthrough. Among others, the ultra-clean technology made a significant contribution in terms of the required removal of disturbances caused by ultratrace amounts of impurities which mixed in the course of processing and the realization of a low-temperature semiconductor process. Tadahiro Ohmi

proposed the importance of ultra-clean technology and gave guidance to companies concerned about a wide range of technologies required for its realization, and thus the development of new technologies were carried out and the said proposal took root in industry. In addition, based on the said technology, he proposed a total low-temperature process or resource-saving/waste-saving production technology, where all LSI production processes were operated under 500°C or less, and for this purpose, he promoted the development of new technologies as well. It is safe to say that these achievements made substantial contributions to the construction of the infrastructure for semiconductor technologies in 21the century.