

[Nano device]

An R&D Project on Quantum Functional Devices

Shun-ichi Gonda

Fukui University of Technology

3-6-1 Gakuen, Fukui 910-8505, Japan

From 1991 to 2000 fiscal year an R&D project on Quantum Functional Devices (QFD) has been promoted in Japan, which is carried out by Electrotechnical Laboratory of the Ministry of International Trade and Industry (MITI) and the Research and Development Association for Future Electron Devices (FED) under the support of MITI through the New Energy and Industrial Technology Development Organization (NEDO). The total budget of the QFD project from fiscal 1991 to 1999 is about 6.4 billion yen.

The purpose of QFD project is to explore in advance the frontier of silicon integrated circuits and to positively apply quantum effects inevitable in the nano-scale region to functional device operation. R&D schedule of the project has been divided into three terms. In the third terms three categories, that is, QFD integration technologies, higher performance QFDs, and single-electron device circuits have been investigated and developed.

Eight private companies have been subcontracted with FED. The themes of each company are, Multi-valued logic devices using tunneling-controlled functional devices (NEC Corp.), Logic/memory devices utilizing quantum-energy-levels (Fujitsu Ltd.), Quantized-band-coupling multi functional devices (Motorola Inc.), Silicon-insulator tunneling memory devices ((Matsusita Electric Industrial Co, Ltd.), Coupled-quantum-dot functional memory devices (Sony Corp.), Quantum-wave switching functional devices (Hitachi Ltd.), Single-electron logic devices (Hitachi Europe Ltd.) and CMOS-coupled single-electron devices (Toshiba Corp.).

ETL is in charge of developing fundamental technologies to realize quantum functions. Some professors from universities also have been subcontracted with FED for studying fundamental technologies.

I have related to this project from the beginning as one of members of committees in FED or MITI. In the meeting, I would like to introduce the outline of the main achievements of the project.