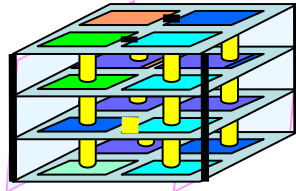


3-Dimensional Semiconductor Technology

Outline of Technology

- Semiconductor technology development that realizes high speed, high functionality and low power consumption by developing and integrating spatial structure technology because of the realization of a high function semiconductor that can respond to the expectations for various social and life needs in the future.

3-dimensional semiconductor (Dream Chip)



Superiority of Japanese Technology

- Japan has led the world in developing elemental technology and DRAM layering technology since 1999.
- Advanced approach in the development of 3-dimensional semiconductor technology of the heterogeneous chip mix type.
- European countries and the United States commenced full research in 2000.
- Korea is working on research and development specializing in the lamination layers of more simple homogeneous chips (memory.)

Impact on Society

Innovative user interface through small highly functional semiconductors

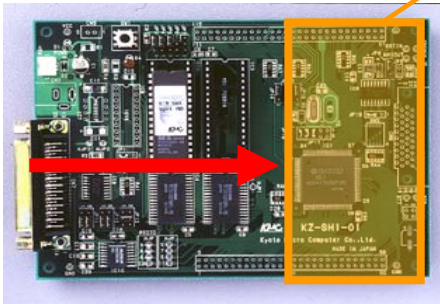
- **Realization of mobile terminals that can be used by the elderly etc through a personal interface based on the characteristics of the user.**

(Examples of User Interface Usage)

- **Phonetic Recognition:** mobile terminal that can understand natural language rather than fragments and operate.
e.g.) information search based on audio (routing assistance and accident information for transportation facilities via audio) automatic translation, simultaneous interpretation etc.
- **Image recognition** (movement of the eyes, mouth, winking etc)
: mobile terminal that can be operated using movement and image information.
i.g.) Operates like as mouse through movement of the eyes, understands sign language and input email, translates to audio for communication etc.



- 1) Realization of compact dimensions
- 2) Realization of multifunctional high level devices through using 3-dimensional technology.



Required Framework for Technology Development

- System that the government is hand-in-hand with the private sector from the viewpoint of an early infrastructure development that includes the design environment and intellectual property strategy.
- Diverse collaborative system with LSI manufacturing business owners relating to LSI manufacture and users for the utmost efficiency of the LSI 3-dimension.
- Promotion of common specifications and a development environment put in place (development of an environment with a low entry barrier.) Also the development of an early development support system by releasing the design.
- Output research and development system by the private sector.

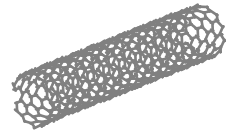
Required Reformation in Social System

- None

Carbon Nanotube Technology (Capacitor Development)

Outline of Technology

- Technology to apply excellent characteristics such as the high electron mobility and large surface area in capacitors (condensers.)
- Enables the realization of charge-discharge characteristic and long lifetime.



Carbon Nanotube



Capacitors
(1000F, 10 to 15 cm height)

Superiority of Japanese Technology

- Japan is dominant in the technology of CNT that was discovered and patented in Japan. Moreover, related patent applications are at a global top level too.
- “Super-growth” method, one of the methods of synthesizing long single-walled CNT, was discussed in ‘Science’ magazine and its number of quotes is the top in the chemical field.
- International standardization of CNT is being developed with the initiative of Japan.

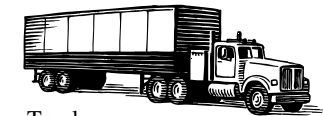
Impact on Society

- Capacitors, which need little time to charge and discharge and don't require maintenance, can be expected to have various applications as an electric source through parallel use with rechargeable batteries. However, current capacitors using activated carbon as the anode do not correspond with the performance required in a wide range of products.
- It aims at the development of the CNT capacitor with ten times the output power and twice the energy density compared with a current product by applying “super-growth” method, one of the methods of synthesizing CNT, which was developed in Japan and is the best in the world. o develop CNT capacitors will enable application in various products that can't be applied with current capacitors, for example, transportation machinery such as trucks, and construction and cargo handling machines such as power shovels, and an electric source for starting cars, thereby doing away with the idling in cars. And thus it contributes to the realization of an energy conservation society.
- CNT capacitors can be expected to replace most of the current capacitor market (140 billion JPY, 2009 estimation). Broad application and market expansion will progress if the electrostatic capacity improves the scale.

※Objective period of practical application of capacitor

2012: applied in mobile devices, 2015: applied in printers and copiers, 2020: applied in hybrid construction equipment and forklifts.

Future View of Capacitors



Truck

With hybrid application, fuel consumption could be less than 65%. Nitroxide would drop by 44% as well.



Wind Generation

Enables stable electric power supply by reserving electricity depending on the strength of the wind.



Trains

Application as the motive energy saves electric power by returning to the overhead wire when braking.

Required Framework for Technology Development

- Implementation system of experimental studies aiming at practical application.
- Establishment of a collaborative environment for industry, academic and the government wherein research institutes and private companies can work on cooperative experiments in a flexible manner.

Required Reformation in Social System

- Promoting development of measurements and evaluation technology and international standardization of CNT.
- Promoting specification of CNT application products to secure international domination.