

Summary of Session VI, “Beyond CMOS technology”

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(1) New system architectures for non Si-CMOS

(Prof. D.Hammerstrom)

- **Semiconductor industry is facing significant challenge**

“Difficulties of Moore’s Law”, “Walls of parallel programming”, “Complexity crisis”

- **Nanogrids as a candidate for Post-CMOS**

- ✓ Consisting of horizontal and vertical nanowires, and a layer of some chemical

- ✓ CMOL (CMOS/Molecular)

Molecular switches with nanowires connected to the underlying CMOS by pins
CMOS for current drive, I/O, and signal restoration

- ✓ Providing extremely high density and low power

- **Challenge to nano-system architecture**

- ✓ Requirement of total system solution, more than just increased density

- ✓ Intelligent Computing

Transformation and understanding of data between RW and DW

- **Biological System**

- ✓ Neural circuits with inspiration of neuro science and cognitive science

- ✓ Skepticism, but challenge to a renaissance in developing such algorithm

- ✓ Applications : Hypothetical Cortical Processor for Robotics, for example

Bayesian memory, Distributed representation

(2) Flexible electronics using OTFT (Prof. T.Someya)

● A new class of electronics in the ambient electronics era

- ✓ Multiple electronic objects scattered everywhere and interacting each other to enhance safety, security, and convenience
- ✓ Fusion of silicon and organic transistors will connect real space and cyberspace.

● Features of organic transistors

- ✓ Complimentary to main stream of Si LSIs
- ✓ Ultra low cost, low weight, ruggedness, and mechanically flexibility

● Applications of organic transistors

- “E-paper”, “Wireless-tag”, “OLED”, “OTFT”
- ✓ Suitable for large-area circuit applications, in particular “Sensors” + “Actuators”

● Development of sheet-type devices with organic transistors on plastic films

- ✓ Devices developed using printing technology
“Eskins”, “Sheet scanner”, “Sheet-type Braille displays”,
“Wireless power transmission sheet”
- ✓ New applications

(3) Future of Microelectronics

- Microelectronics in Future- (Prof. P.Lugli)

- **Nanoelectronics**

- ✓ Expected to provide the basis for continued scaling into the next decade
- ✓ Expected to lead to devices and circuits alternative to the current CMOS

- **Molecular systems**

- ✓ Organic semiconductor devices are available
“Organic photo diode”, “Organic thin film transistor”
- ✓ Single molecule electronics offers the possibility of ultra large scale integration

- **Semiconducting nanostructures**

- ✓ Si-nanowire / Carbon nanotube transistors are promising

- **Circuit / architecture**

- ✓ The interaction between neighbouring nanostructures provides local interconnectivity, high parallelism and ultra-large-scale integration
“ Crossbar memory with molecules or conducting oxides”,
“Quantum cellular automata with coupled nanomagnet”

Beyond CMOS technology is;

Biology & Brain

ecologically

yields

Organic & oxides

nano- but niche

demonstrations

Carbon based

Materials & Molecules

Off road

Si as a Substrate