

MATSUMURA Masakiyo (1941 – 2021) “A Pioneer of Large-Scale Integrated Circuits based on Thin-Film-Transistors for Large Area Display Devices”

1. Biography

Born in Gunma Prefecture in 1941. Graduated from Tokyo Institute of Technology B. Eng. in Electrical Engineering in 1964, and M. Eng. in 1966. Joined NEC Corporation in 1966. Obtained Dr. Eng. In 1976 from Tokyo Institute of Technology. Appointed as Associate Professor of Physical Electronics at Tokyo Institute of Technology in 1976, Professor of Engineering in 1985, and then Professor Emeritus in 2001. Became a Fellow of ALTEDEC Corporation in 2001. Served the President of the Japan Society of Applied Physics in 2000–2002.



(MATSUMURA, Masakiyo)

2. Abstract

MATSUMURA Masakiyo was a pioneering leader of large-scale integrated circuits based on thin-film-transistors, which was applied in large-area flat-panel displays, based on the idea that amorphous silicon could be used as switching devices for liquid-crystals in 1970s. He also invented methods for growing polycrystalline and single-crystal silicon on glass substrates by excimer-laser annealing. This technology not only made possible the application for high performance large area flat-panel displays but also for the foundation of system-on-glass integrated circuits.

3. Research Summary

3.1 Fabrication of amorphous-silicon-based thin-film transistors.

In 1975, Spear and LeComber in Dundee University, UK, published that electrical conductivity could be controlled by doping in amorphous silicon prepared by glow-discharge of silane gas. The impact of this report was tremendous that many researchers in the world rushed to study fabrication and properties and application of amorphous silicon particularly solar cell devices. Matsumura realized that this material could be useful for thin-film electron devices and started research on application for flat-panel-display in conjunction with liquid crystals.

Matsumura published their results on amorphous silicon based thin-film transistors in 1979 [1,2], but it was half a year later than the first report of the same subject from Dundee University. After the extensive work, Matsumura laboratory at Tokyo Tech became world leader of

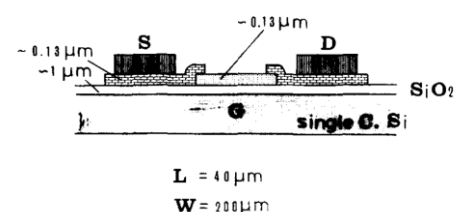


Fig. 1: Structure of experimental a-Si thin-film MOSFET (Appl. Phys. Lett. 1980).

the research on amorphous silicon based thin-film transistors. Many researchers from the world, including Korea, the Netherlands, U.S.A. joined his group and studied technology for thin-film transistors and contributed commercialization of active-matrix liquid-crystal display in 1990s. Large-screen flat-panel TVs and PCs with flat-panel monitors appeared in the market.

3.2 Growth of single-crystalline silicon on glass substrates by excimer-laser annealing.

Polysilicon films with higher electron mobility than amorphous silicon made possible fabrication of high performance thin-film transistors, which can be used to drive flat-panel display circuits as well as switching liquid-crystals.

Matsumura invented methods for growing polycrystalline and single-crystal silicon on glass substrates by excimer-laser annealing. This technology not only made possible the application for high performance large area flat-panel displays but also for the foundation of system-on-glass integrated circuits.

4. Remarks

When flat panel displays based on amorphous silicon thin-film-transistors commercialized in the market, Matsumura described “in the past, people told that thin-film transistors should not be useful so it was not worth to study it in the university, now people say thin-film transistors has already in the phase of mass-production, it is not appropriate to research in the university [5]”. Matsumura always pursue an original work, which is never done anywhere else.

5. References

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6. Books

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