

NEC Develops Highly-Reliable High-K Gate Dielectric Film Transistor

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NEC Corporation ("[NEC](#)") and NEC Electronics Corporation ("NEC Electronics") today announced the development of technology for the realization of sub 0.1um generation, low-power [SOC](#) devices, which require high-K gate dielectric film to suppress leakage current. The newly developed technology increases the life time of high-K gate dielectric film by up to 10 years with practical usage presumed at 85°C.

This result was mainly enabled by the following:

- (1) It was determined that the main cause of the characteristic change after prolonged use of a transistor possessing high-k gate dielectric film, which is the greatest challenge facing commercialization, is the electron trap inside the dielectric film.
- (2) Stable operation of the transistor after prolonged use is realized through use of HfSiON (Hf) high-k gate dielectric film, along with optimization of the nitridation process of high-k gate dielectric film that control characteristic change of transistors.
- (3) In addition to clarifying electric field dependency of the defect generating mechanism causing leakage current increases, NEC developed an accurate life time measurement method for power voltage consumption in products, which guarantees high reliability.

The newly developed technology solves many problems including stable current output after prolonged operation on high-k gate dielectric film, which wasn't conventionally attainable, while guaranteeing product life span that can be easily affected by defects causing leakage current

increases. This result is considered a large step toward the realization of low-power-consuming devices using high-k gate dielectric film.

If this technology is installed in the latest slim devices and applied to mobile equipment such as mobile handsets that are vital to the coming ubiquitous society, production of high-speed SOC without shortening of the battery life span will be enabled contributing to the spread of highly reliable mobile devices.

NEC and NEC Electronics will accelerate research and development efforts of this high-K gate insulator working toward the provision of highly reliable mobile terminals for a ubiquitous society. This research will be announced at SSDM 2004(International Conference on Solid State Devices and Materials), which will be held from 15-17 September, 2004 in Tokyo.

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