NEC Develops Highly-Reliable Metal/High-K Gate Stack Transistor

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NEC Corporation (NEC) today announced the joint development of a new technology for realizing low-power and high-performance SOC devices of technology nodes of 65 nm, 45 nm and beyond. The developed technology enables fabrication of a highly reliable metal/high-k gate transistor utilizing a simple method.

This research result was achieved by the following:

(1) Use of a highly reliable HfSiON (Hf) high-k gate dielectric film and a Ni-silicide gate electrode that is compatible with conventional processes.

(2) Clarification of the impact of the crystalline phase of a Ni-FUSI gate electrode on long-term reliability.

(3) A combination of NiSi (n-FET) and Ni3Si (p-FET) is adopted to ensure reliable performance.

(4) A newly developed method realizes control of the thickness of the silicon for the silicide formation, thereby enabling clear definition of the crystalline phase of NiFUSI, even in short channel gates.

(5) While controlling the height of the gate electrode, compressive force was intentionally applied to the p-FET channel region, enhancing mobility of holes.

To date, there have been several issues with metal/high-k gate stacks including the maintenance of stable current output after prolonged operation, which has not been realized due to increased current leakage through the ultra-thin gate stack. The newly developed technology solves this major issue, in addition to lowering production costs owing to the simple process and high uniformity in transistor performance. This is a large step toward the realization of low-power-consuming devices with a metal/high-k gate stack, prolonging the battery life of mobile equipment.

NEC will accelerate its research and development on metal/high-K gate stacks toward the provision of highly reliable, low-power mobile terminals, vital in a ubiquitous networked society. The details of this research will be presented at the 2006 symposium on VLSI technology, which is being held from June 13 to 15 in Hawaii, U.S.A.

Source: NEC