Sandia-developed dielectric thin films enable low-breakdown voltage antifuses

Researchers at Sandia National Laboratories have developed an inexpensive, reliable and easy-to-manufacture class of dielectric films that have the capability of enabling programmable antifuses on integrated circuits (IC) at less cost and using easier-to-manufacture methods. The new Sandia films enable single-mask level sub 5 Volt write antifuses that are compatible with leading-edge IC specifications.

Antifuses are nonvolatile, one-time programmable memories fabricated on ICs that are programmed with applied voltage. People who need specially designed chips that are generally not available can use inexpensive chips made with the Sandia-developed dielectric film and permanently program them after fabrication.

This technology inexpensively enables such activities as post fabrication trimming, ROM programming, on-chip serial number identification, and data and program security. Chips with antifuse devices may also be used in high radiation environments or for long-term storage where flash memory would not be reliable.

“Antifuses have been around a long time,” says Paul Smith, who is involved in technology transfer at Sandia. “The new Sandia-developed film — that ultimately is incorporated into computer chips with antifuses — requires lower voltage and less real estate. This makes them more desirable than existing antifuses.”

Smith hopes to attract outside companies to be Sandia partners who would commercialize the new film technology.

Current antifuse technologies rely on complex stacks of ultra-thin films that are foreign to standard Complimentary Metal Oxide Semiconductor (CMOS) processes. These existing multi-stack solutions use write voltages significantly greater than 5 Volts, making existing antifuses incompatible with many leading-edge IC designs. The depositions of these films can also be difficult to control during production, resulting in a potential for poor yield and reliability issues.

“In addition to compatibility with state-of-the-art ICs, Sandia’s novel antifuse technology offers great flexibility toward where the antifuse can be placed in an IC,” says Scott Habermehl, one of the inventors of the dielectric film. “It can readily be integrated into either the front end or the back end wiring.” He adds that the new dielectric technology enhances both process margin and device reliability since it allows manufacturers to use thicker films for the antifuse elements.

Sandia’s dielectric technology leverages existing fabrication equipment and infrastructure without the need for costly, specialized and dedicated tooling and facilities. The dielectric films were developed by Sandia researchers Scott Habermehl, Roger Apodaca and David Stein.

Source: Sandia National Laboratories