PENN CENTER FOR INNOVATION
Empowering Ideas

Resistance Switching Materials for Next Generation Non-Volatile Memory

Inventor
Dr. I-Wei Chen

STAGE OF DEVELOPMENT
Thin film materials

INTELLECTUAL PROPERTY
US Patents 8,106,375 & 7,666,526, other pending patent applications

DESIRED PARTNERSHIPS
- License
- Sponsored Research

LEARN MORE
Ryne DuBose
rdubose@upenn.edu
215-746-8107

Docket # 14-7119

Problem
Flash memory is beginning to reach its performance limit. Other emerging memory technologies face challenges that limit their practical use. Resistance switching memory is a leading contender for the next generation of computer memory, but most resistance switching materials are prone to filamentary breakdown, which causes failure and limits device reliability. There is a great need to develop resistive switching materials that are reliable and also compatible with standard complementary-metal-oxide-semiconductor (CMOS) manufacturing technology.

Solution
Dr. I-Wei Chen's group has developed new resistance switching materials with several key advantages. These materials exhibit robust performance with low switching voltages and high switching speeds, ideal for use in a memory device. Switching behavior has been demonstrated in a wide variety of materials, many of which are compatible with today's semiconductor fabrication processes. Other resistive random access memory (RRAM) devices rely on expensive heavy metal dopants to enable switching behavior in insulating thin films. Chen's group has extended the universe of materials that exhibit thickness- and voltage-dependent switching behavior via unprecedented compositions, which do not require metal incorporation and are compatible with current CMOS technology. The compositions include silicon, germanium, silicon carbide, gallium arsenide, gallium nitride, indium phosphide, indium arsenide, zinc oxide, and numerous other materials.

Advantages
- New class of materials for memory applications
- Metal-free compositions
- Increased CMOS design and processing compatibility
- Decreased material and fabrication costs