Abstract

Research into new random access electronic memory technologies has grown significantly in the past 10 years due to the near realization of the scaling limits of DRAM and the low cycle lifetime, high power requirements, and radiation sensitivity of Flash. At the forefront of this research is the phase-change random access memory (PCRAM). Phase-change memory is a non-volatile, resistance variable memory technology whereby the state of the memory bit is defined by the memory material’s resistance. Chalcogenide materials, those containing S, Se, or Te, have been the most widely investigated materials for electronic resistance variable memory applications since the discovery of the electronic resistance switching effect in a chalcogenide material. Chalcogenide materials are desirable for use in electronic memories due to the wide range of glasses they can form and the corresponding wide variety of glass transition and melting temperatures. One of the most well studied resistance switching chalcogenide materials is the Ge$_2$Sb$_2$Te$_5$ (GST) alloy, but there have been many challenges to the implementation of a phase-change memory product such as the high programming current requirements, variation in switching voltages and ON/OFF resistance ratios, thermal stresses on the materials, and their adhesion to the electrodes.

Boise State University has invented a memory device with multiple memory states and the ability to hibernate in a circuit until ‘activated’. Our device contains a new material, and method of activating the material, used for non-volatile memory technology. The devices tested included three alloy stacks consisting of Ge (Germanium), Te (Tellurium), Se (Selenium) and Sn (tin). All devices showed resistance switching, phase change memory behavior. Potential uses of this technology include a memory device capable of exhibiting more than two data states.

Advantages

- Capable of exhibiting more than two data states (current memory devices).
- Benefits include increased memory density due to having more than two data states and ability to function as a fuse or ‘activated’ memory device.

Stage of Development

This technology is developed and a patent has issued.

Boise State is looking for a Licensee for this technology.

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