Contribution ID: **97** Type: **not specified**

Optimization of Properties of Bismuth doped Germanium-Antimony-Selenium-Tellurium for Threshold Switching Applications

Thursday, 16 November 2023 10:00 (15 minutes)

There is a pressing need for the development of reliable, cost-effective sources of nonvolatile electronic storage devices due to the increase in the rate at which information is exchanged during this digital era. Phase change memory (PCM) is more predictable, less expensive, scalable and has an indefinite cyclability compared with other electronic memories like silicon-based flash memory. PCM is based on stable chalcogenide alloys containing selenium or tellurium, which switches very fast between the amorphous and the crystalline states. However, the details of the crystalline to amorphous switching process utilized for memory storage remains an active research area with many incomplete details. Although studies have been done on germanium (Ge) – antimony (Sb) – tellurium (Te) thin films for use in PCM technology, selenium-bismuth (Se-Bi) doping, surface passivation and film thickness optimization on threshold switching properties has rarely been investigated. The study focuses on investigating these properties in addition to the role of materials' preparation conditions, in the understanding of the optimized properties of Ge-Sb-Se-Te thin films for application in PCM technology. The objectives of the study are: To investigate the effect of film thickness, and to determine the effect of surface passivation on the optical, electrical, and structural properties of as-deposited and annealed Ge-Sb-Se-Te thin films, and to examine the effect of film thickness and surface passivation on the threshold voltage of Ge-Sb-Se-Te thin films. Optical absorption spectroscopy, differential scanning calorimetry (thermal properties), X-Ray diffraction (structural properties), scanning electron microscopy (morphological properties), and temperature dependent electrical conductivity, are among the techniques to be applied to the study of flash evaporated thin films of Ge-Sb-Se-Te. It is expected that the analyzed thin films prepared under varied conditions will be compact, stable and have optimized properties for production of PCM devices with maximum performance and will be readily accessible. This is expected to improve on the speed and time saving which will lead to an efficient electronic storage system in both government and private institutions.

Primary authors: MULAMA, Austine Amukayia (Maseno University, Kenya); ODUOR, Andrew (Maseno University); MWABORA, Julius (University of Nairobi); MUIVA, Cosmas (Botswana International University of Science and Technology)

Presenter: MULAMA, Austine Amukayia (Maseno University, Kenya)

Session Classification: Partner

Track Classification: Partner