Stack-Structured Phase Change Memory Cell for Multi-State Storage

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Abstract

In PRAM applications, the devices can be made for both binary and multi-state storage. The ability to attain intermediate stages comes either from the fact that some chalcogenide materials can exist in configurations that range from completely amorphous to completely crystalline or from designing device structure such a way that mimics multiple phase chase phenomena in single cell. We have designed stack-structured phase change memory cell which operates as multi-state storage. Amorphous Ge_xTe_{100-x} chalcogenide materials were stacked and a diffusion barrier was chosen for each stack layers. The device is operated by crystallizing each chalcogenide material as sequential manner from the bottom layer to the top layer. The amplitude of current pulse and the duration of pulse width was fixed and number of pulses were controlled to change overall resistance of the phase change memory cell. To optimize operational performance the thickness of each chalcogenide was controlled based on simulation results.