

Three Dimensional Architecture for High Density PCRAM

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ABSTRACT

Three dimensional architecture is essential for high density PCRAM (Phase Change Random Access Memory) with Tera bit level. A cost effective structure as like BiCS (Bit Cost Scalable) type in NAND flash memory may be one of solutions. In this study, cost effective three dimensional architecture using heating at only sidewall region of PCM (Phase Change Material) layer is investigated. In this structure, at first, thin PCM and thick conduction layers are directly stacked. After the formation of several stacked PCM and conduction layers, and the hole patterning for vertical cell and the sidewall opening of only PCM layer are performed. From this architecture, we realized the operation of PCRAM using heating at only sidewall region of PCM, which is areal of under $10 \times 10 \text{ nm}^2$, by the TCAD simulation method. Furthermore, the thermal disturbance for different materials such as $\text{Ge}_2\text{Sb}_2\text{Te}_5$ and GeCu_2Te_3 are investigated in this three dimensional architecture. It is confirmed that PCRAM using GeCu_2Te_3 is more effective for high density architecture compared to one of $\text{Ge}_2\text{Sb}_2\text{Te}_5$ owing to higher crystalline temperature.

Key words: 3D architecture, $\text{Ge}_2\text{Sb}_2\text{Te}_5$, GeCu_2Te_3 , PCRAM, TCAD simulation, BiCS.