Effect of contact resistance on PRAM window in 3D structure

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ABSTRACT

The next-generation memories have been developed for non-volatile memory (NVM) and scalability. Above all, Phase-change Random Access (PRAM) is the greatest potential to improve in power consumption, integration and multi-level property. The analysis of interface electrical and thermal properties is essential for nano-scale PRAM. Especially, contact resistivity plays an important role in joule heating and in decision of the window for set and reset state. This paper shows the effect of contact resistance which is sensitively changed by process condition on the memory window. The contact resistance more increases the total resistance in the set state than in the reset state. Increasing resistance in the set state causes the memory window to decrease. So, it`s significant to reduce the effect of contact resistance. We propose the three-dimension (3D) contact structure of step shape to improve the memory window. The step shape reduces the contact resistance due to enlarge the contact area. So, the proposed structure improves the memory window. By TCAD tool, we investigate memory window and operation current using Ge2Sb2Te5 as phase-change material (PCM) in various step angles.

Key words: Contact resistance, Memory window, 3D structure, PRAM, Step shape.