

Atomic layer deposition of In–Sb–Te Thin Films for PRAM Application

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For the programming volume of PRAM, Ge₂Sb₂Te₅(GST) thin films have been dominantly used and prepared by physical vapor deposition (PVD), chemical vapor deposition (CVD), atomic layer deposition (ALD). Among these methods, ALD is particularly considered as the most promising technique for the integration of PRAM because the ALD offers a superior conformality to PVD and CVD methods and a digital thickness control precisely to the atomic level since the film is deposited one atomic layer at a time. Meanwhile, although the IST has been already known as an optical data storage material, recently, it is known that the IST benefits multistate switching behavior, meaning that the IST-PRAM can be used for multi-level coding, which is quite different and unique performance compared with the GST-PRAM. Therefore, it is necessary to investigate a possibility of the IST materials for the application of PRAM. So far there are many attempts to deposit the IST with MOCVD and PVD. However, it has not been reported that the IST can be deposited with the ALD method since the ALD reaction mechanism of metal organic precursors and the deposition parameters related with the ALD window are rarely known. Therefore, the main aim of this work is to demonstrate the ALD process for IST films with various precursors and the conformal filling of a nano size programming volume structure with the ALD/IST film for the integration.

InSbTe (IST) thin films were deposited by ALD method with different precursors and deposition parameters and demonstrated conformal filling of the nano size programmable volume of cell structure for the integration of phase change random access memory (PRAM). The deposition rate and incubation time are 1.98 Å/cycle and 25 cycle, respectively. The complete filling of nano size volume will be useful to fabricate the bottom contact type PRAM.

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