멀티레벨 상변화 메모리 응용을 위해 화학기상증착법으로 저온에서 증착시킨 InSbTe 박막의 특성평가

Conformal Properties of InSbTe Thin Films Grown at a Low Temperature by MOCVD for Multi Level Phase-Change Memory Applications

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Abstract : The feasibility of InSbTe (IST) chalcogenide materials prepared by metalorganic chemical vapor deposition (MOCVD) for phase-change memory (PRAM) applications was demonstrated. Films grown below 225 °C exhibited an amorphous structure, and the films grown at 300 oCincludedvariouscrystallinephasessuch as In-Sb-Te, In-Sb, In-Te, and Sb-Te. The composition of the amorphous films grown at 225 °C was dependent on the working pressure. Films grown at 225 °C exhibited a smooth morphology with a root mean square(rms) roughness of less than 1nm, and the step-coverage of the films grown on a trench structure with an aspect ratio of 5:1 was greater than 90%.An increase in deposition time increased the filling rate, while retaining the conformal step-coverage.Films grown at 225 °C for 3h in a working pressure of 13×10^2 Pa exhibited a reproducible and complete filling in a trench structure.

Key Words : InSbTe materials, MOCVD, Multi Level, Phase change memory.

1. 서 론

Phase-change memory (PCM) is one of the most promising candidates for next-generation, non-volatile memory devices. IST materials have many advantages for PRAM applications, deposition process of IST by metal-organic CVD (MOCVD) for filling in trenches is very sensitive to deposition conditions.[1-2] In the present study, we report the successful growth of IST films that possess the functional properties required for PRAM applications using both MOCVD and reliable filling of trench structures with a height of 500 nm and a diameter of 100 nm (aspect ratio of 5:1).

2. 결과 및 토의

The IST films grown below 225 °C using MOCVD exhibited an amorphous structure, while the films grown at 300 °C exhibited various crystalline phases. The films grown at a deposition temperature of 225 °C, a Sb-precursor bubbling temperature of 30 °C, and a working pressure of 13×10^2 Pa showed a close stoichiometric composition ($In_3Sb_1Te_2$) of IST. The films grown at 225 °C for 1h in a trench with an aspect ratio of a 5:1 exhibited the step-coverage of approximately 90%. An increase in deposition time for 3h at a working pressure of 13×10^2 Pa increases the filling rate, while retaining the homogeneous conformal coverage.

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