# Physical properties of sputter grown Bi-Te and GeTe/Bi-Te superlattice films

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**ABSTRACT**

GeTe/$Sb_2Te_3$ chalcogenide superlattice (SL) films have been attracting considerable attention for future non-volatile memory application due to much lower power operation with faster switching speed. Furthermore, unusual properties such as magnetoresistance and magneto optical Kerr rotation have been reported in such SL, which are not observed in Ge-Sb-Te composite materials. They speculatively attributed to topological insulating nature of the $Sb_2Te_3$ layer, namely, each GeTe/$Sb_2Te_3$ interface possesses a Dirac cone as a result of strong spin-orbit coupling as well as spatial inversion and time reversal symmetries. So far, only the $Sb_2Te_3$ has been used as a topological insulator layer in chalcogenide superlattice. In this work, we propose to use $Bi_2Te_3$. $Bi_2Te_3$ is a well-known thermoelectric material showing n-type conductivity, while conventional phase change materials like GeTe, $Sb_2Te_3$, and $Ge_2Sb_2Te_5$ exhibit p-type conduction in both amorphous or crystalline states. On the other hand, in terms of crystal and electronic structures, $Sb_2Te_3$ and $Bi_2Te_3$ closely resemble each other, namely, both crystallize into a rhombohedral tetradymite structure with space group R-3m (166), and both are typical topological insulators. In spite of such similarities, Bi-Te alloys have not been considered for use as phase change memory. We report fundamental properties of sputter grown Bi-Te and GeTe/Bi-Te superlattice films were studied experimentally and theoretically and, their properties were compared with the GeTe/$Sb_2Te_3$ superlattice.

**Key words**: Phase change material, chalcogenide superlattice, Bi-Te.