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Topological insulating behavior in conducting property of crystalline Ge-Sb-Te JEONGWOO KIM, JINWOONG KIM, SEUNG-HOON JHI, Physics, POSTECH — Phase-change random access memory (PRAM) is one of the most promising materials for data storage application. Especially, Ge-Sb-Te(GST) is considered as the best candidates for next generation nonvolatile memories because of the rapid and reversible cycles between the crystalline and amorphous structures. GeTe and $Sb_2Te_3$are the main components of GSTs, and have finite band gaps in the bulk phase. Sb_2Te_3 is topological insulator that has gapless edge states while maintaining bulk energy gap. These surface states are robust to external perturbations because they are protected by time-reversal symmetry. We report a discovery, through first-principles calculations, that crystalline GST phase-change materials exhibit the topological insulating property. Our calculations show that the materials become topological insulator or develop conducting surface-like interface states depending on the layer stacking sequence. It is shown that the conducting interface states originate from topological insulating Sb_2Te_3 layers in GSTs and can be crucial to the electronic property of the compounds. These interface states are found to be quite resilient to atomic disorders but sensitive to the uniaxial strains. We presented the mechanisms that destroy the topological insulating order in GSTs and investigated the role of Ge migration that is believed to be responsible for the amorphorization of GSTs.

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