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Long-Range Potential Fluctuations in GST Chalcogenide Glasses
RAJEEV GUPTA, Department of Physics and Materials Science Programme, IIT Kanpur, India, CH. BAPANAYYA, Materials Science Programme, IIT Kanpur, India, S.C. AGARWAL, Department of Physics, IIT Kanpur, India — Ge-Sb-Te (GST) alloys are widely used for data recording based on the rapid and reversible amorphous to crystalline phase transformation that is accompanied by an increase in the optical reflectivity and electrical conductivity. However, their application in advanced memory technology is limited by their endurance; $Ge_2Sb_2Te_5$ (GST225) switch has the longest life. Search for more efficient materials has been on, but has not been fully successful so far. This is primarily because one does not know the algorithm to prepare such a material. In this paper, electrical transport properties - electrical conductivity and thermopower of GST alloys are studied and the widths of long-range spatial potential fluctuations present in thin films are estimated. The study shows that amorphous GST225 has the smallest potential fluctuations among all the alloys studied. This finding is correlated to the performance of the phase change materials. The presence of potential fluctuations increases the minimum free energy of the amorphous phase. This deteriorates the switching ability after a few cycles. This suggests that the material with smaller potential fluctuations is likely to be better suited as a switch with a longer life.

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