Growth of GeTe and Sb2Te3 interlayer structures for interfacial phase change devices via molecular beam epitaxy

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Phase change memories (PCMs) are based on the bad glass forming ability and metastability of the thermodynamic and kinetic transition in chalcogenide materials. This relies on the electrical and optical properties changing substantially when the atomic structure of the materials is altered. This transition, between a significant electrical resistance in the amorphous phase and a highly conductive state in the crystalline phase, has lent itself to numerous applications that include optical storage (i.e. blue ray and CDs) to electronic devices (i.e. Intel x-point technology). A novel subset of these materials uses the superlattice structure in order to greatly reduce the switching current and total energy required, thereby overcoming the joule heating constraint common to conventional PCMs. These are known as interfacial phase change materials (iPCM). Though currently unsettled as to the origins of the mechanism, they have shown promise for use in microwave devices based on interlayer switching by reducing the thermal loads required. In this presentation, we investigate the growth of interfacial GeTe-Sb_2Te_3 structures via Molecular Beam Epitaxy (MBE) with differing orientations and various substrates (GaAs, Si, Al_2O_3) and report on the electro-optical properties associated with the morphological and structural changes in this material system. By varying the elemental flux and novel heating method, we are able to stabilize the superlattice structure in a 2D growth regime. The ability to grow via MBE on transparent substrates allows us to incorporate the iPCMs into next-generation optical devices.