Experimental Observation of Intrinsic Localized Modes in Germanium

Abstract
Deep level transient spectroscopy shows that defects created by alpha irradiation of germanium are annealed by low energy plasma ions up to a depth of several thousand lattice units. The plasma ions have energies of 2–8 eV and therefore can deliver energies of the order of a few eV to the germanium atoms. The most abundant defect is identified as the E-center, a complex of the dopant antimony and a vacancy with an annealing energy of 1.3 eV as determined by our measurements. The inductively coupled plasma has a very low density and a very low flux of ions. This implies that the ion impacts are almost isolated both in time and at the surface of the semiconductor. We conclude that energy of the order of an eV is able to travel a large distance in germanium in a localized way and is delivered to the defects effectively. The most likely candidates are vibrational nonlinear wave packets known as intrinsic localized modes, which exist for a limited range of energies. This property is coherent with the fact that more energetic ions are less efficient at producing the annealing effect.