Nanoparticle Floating Gate Flash Memories

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We will discuss the use of Si and SiGe(C) nanoparticle formation on high-k dielectrics as charge storage nodes in NC Flash memories. When applying high fields for programming or erase operations the energy band in the high-k dielectric bend sufficiently to cause Fowler Nordheim (FN) tunneling through a narrow triangular barrier, while higher bandgap SiO_2 remains in direct tunneling regime, thus helping easier program and erase. In our proposed high-k based cells the memory operations are achieved at lower voltages and reduced charge loss. SiGe NCs possess a lower bandgap than Si NCs, and deeper potential wells when embedded in the gate dielectric and hence longer retention times. A different approach involves demonstrating that a chaperonin protein lattice can be used as a template to assemble nanocrystal (NC) arrays for flash memory fabrication. Different types of NCs from colloidal suspensions can be incorporated into flash memory cells.