Abstract

Theoretical and Experimental Investigation of Si Nanocrystal Memory Device with HfO$_2$ High-k Tunneling Dielectric

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This paper describes improved memory characteristics of the Si nanocrystal memory devices by replacing the traditional SiO$_2$ with HfO$_2$ high-k dielectrics for the first time. Thanks to the combination of a lower electron barrier height and a larger physical thickness of HfO$_2$ as compared with SiO$_2$, the fabricated device shows excellent programming efficiency and data retention characteristic. The single-electron charging effect is clearly observed at room temperature. It also shows superior data endurance up to $10^6$ write/erase cycles.