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Inelastic Electron Tunneling Spectroscopy of Silicon Based MOS Diode with High Permittivity Gate Dielectrics[1] SYUANLONG YOU — Inelastic electron tunneling spectroscopy (IETS) has been known as a powerful technique for detecting the molecular vibrations in the spectra. This technique was also applied to the study of the silicon MOS to reveal the information of electrode phonons, dielectric phonons, chemical bonding, and trap states in MOS structure. In this work IET spectra of silicon MOS diode with SiO_2, high κ HfO_2, and YDH (HfO_2 doped with Y_2O_3) as gate dielectrics were investigated. The gate bias dependence of the IET spectrum enables us to ascribe the vibration mode adjacent to the metal gate interface, or to the silicon substrate interface. We show variations of the IET spectrum with respect to Y_2O_3 doping and annealing conditions of the dielectrics, and compare with reported data of infrared, Raman, and XPS. We also present the changes in IET spectra as induced by electrical stress that eventually leads to soft-breakdown in the dielectrics.

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