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**Characterization of local electronic structure and dielectric properties at a HfO2/SiO2/Si gate dielectric interface.**[1] KLAUS VAN BENTHEM, ORNL, SERGEY RASHKEEV, ORNL, GENNADI BERSUKER, International Sematech, SOKRATES PANTELIDES, Vanderbilt University, STEPHEN PENNYCOOK, ORNL — Electron Energy-Loss Spectroscopy (EELS) measurements were performed using an aberration-corrected Scanning Transmission Electron Microscope (STEM) to investigate local electronic structure across a HfO2/SiO2/Si gate dielectric interface with a lateral resolution of approximately 0.1 nm. The low energy-loss regime in EELS is dominated by intra-and interband transitions and plasmon excitations. Hence, by a Kramers-Kronig analysis of the low energy-loss regime the determination of the complex dielectric function becomes possible on a sub-nanometer length scale. As a consequence, local optical properties and the local interband transition strength can be discussed as a function of position across the gate dielectric. Single Hf atoms present within the SiO2 interlayer introduce localized states in the Si band gap and gradients in the local dielectric function. Microscopic measurements will be correlated with macroscopic device characteristics.

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