Comparison between ultra-thin ZrO_2 and ZrO_xN_y gate dielectrics in TaN or poly-gated NMOSCAP and NMOSFET devices

Renee Nieh, Siddarth Krishnan, Hag-Ju Cho, Chang Seok Kang, Sundar Gopalan, Katsunori Onishi, Rino Choi, Jeong Han, and Jack C. Lee

Microelectronics Research Center, The University of Texas at Austin,
10100 Burnet Road, Bldg. 160, Austin, TX 78758, USA

NMOSCAP and self-aligned NMOSFET devices using TaN gates were fabricated and characterized in order to compare ZrO_2 and nitrogen-incorporated ZrO_2 (ZrO_xN_y) gate dielectrics (EOT~10.3Å). ZrO_xN_y devices demonstrated excellent thermal stability, comparable leakage current, higher breakdown field, decreased subthreshold swing, and improved drive current over ZrO_2 devices. Polysilicon-gated NMOSCAPs were also fabricated to investigate the compatibility of ZrO_xN_y with the poly process (EOT~19Å), but high leakage and TEM analysis revealed interaction between the poly and ZrO_xN_y.