Abstract Submitted
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TEM-EELS Investigation of Boron and Phosphorus Passivated 4H-SiC/SiO$_2$ Interface Structures[1] CHRISTOPHER KLINGSHIRN, JOSHUA TAILLON, University of Maryland, College Park, GANG LIU, Rutgers University, SARIT DHAR, Auburn University, LEONARD FELDMAN, Rutgers University, TSVETANKA ZHELEVA, AIVARS LELIS, US Army Research Laboratory, LOURDES SALAMANCA-RIBA, University of Maryland, College Park — A high density of electronic defects at the SiC/SiO$_2$ interface adversely affects SiC-based metal oxide semiconductor devices. Various treatments are known to improve device performance. Annealing in a nitric oxide (NO) environment, for example, passivates electronic defects at the interface and raises the carrier mobility in the active region to 35-40 cm^2/Vs, but the effect saturates after about 60 minutes of annealing.[1] Passivation with phosphorus[2] or boron[3] improves upon NO by a factor of 2, increasing the mobility to over 90 cm^2/Vs.[2] We investigate the chemical and structural effects of these treatments on the SiC/SiO$_2$ transition layer using high-resolution transmission electron microscopy (HRTEM) and high angle annular dark field (HAADF). Electron energy loss spectroscopy Spectrum Imaging (EELS SI) collected across the transition region allow identification of the width, composition and types of bonding at the transition layer. Advanced machine learning techniques applied to the EELS data reveal intermediate bonding states within this region. [1]J. Taillon et al., J. Appl. Phys. 113, 044517 (2013). [2]D. Okamoto et al., IEEE Electron Device Lett. 31, 710 (2010). [3]D. Okamoto et al., IEEE Electron Device Lett. 35, 1176 (2014).

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