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Charge carrier density and mobility uniformity in SiC(0001) epitaxial graphene[1] CONOR PULS, NEAL STALEY, GREGORY HARKAY, JOSHUA ROBINSON, YING LIU, Pennsylvania State University, JEONG-SUN MOON, HRL Laboratories, KURT GASKILL, PAUL CAMPBELL, JOSEPH TEDESCO, Naval Research Laboratories — In order to optimize electronic transport in epitaxial graphene-based field effect transistors (FETs), the scattering mechanisms and their limits on charge carrier mobility and saturation velocity need to be understood. We evaluated the effects of charge impurity and phonon scatterings in FETs and Hall bar structures (with and without a thermally deposited SiO_2 overlayer). Devices typically featured electron mobilities between 3,000 and 4,000 cm^2/Vs at 2 K. With the application of a magnetic field up to 9 T, the emergence of quantum Hall plateaus in the Hall bar structures was apparent. However, we found variation in the resistance values at the plateaus caused by charge concentration inhomogeneity in the graphene. The effect of inhomogeneity on charge transport is further evidenced by a linear dependence of inverse mobility on charge concentration, providing evidence that charged scatterers in the deposited dielectric rather than phonons limit the mobility at all temperatures. Furthermore, we found that charge concentration inhomogeneity due to a dielectric overlay also affects current saturation in epitaxial graphene FETs. We will also present related work on planar tunnel junction studies of bandgap engineering in bilayer graphene.

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