Fabrication and Characterization of Epitaxial Graphene Field Effect Transistors

YIRAN HU, YIKE HU, Georgia Institute of Technology, JAN KUNC, Georgia Institute of Technology; Charles University, JEAN-PHILIPPE TURMAUD, JAMES GIGLIOTTI, DOGU DAN DENIZ, YUE HU, Georgia Institute of Technology, VLAHI PRUDKO VSKY, Institut Nè el, Université Grenoble Alpes-CNR, CLAIRE BERGER, Georgia Institute of Technology; Institut Nè el, Université Grenoble Alpes-CNR, WALT DE HEER, Georgia Institute of Technology — We report on planar transistors using epitaxial graphene grown both on the (0001) and the (000-1) face of semi-insulating 4H-SiC, following the work reported by Kunc et al.\textsuperscript{1} Epitaxial graphene on SiC is of high quality and holds a high potential for graphene electronics. We use Raman spectroscopy, atomic force microscopy and transport measurements (Current-voltage under various gate voltage) as a function of temperature to investigate the properties of the material and to characterize the devices. On the carbon face (000-1), a 2D Electron Gas (2DEG) is formed between a surface silicate and the SiC bulk after thermal annealing. Multi-layer epitaxial graphene (MEG) is used to contact this 2D conduction layer, forming a 1D junction. Results are analyzed in terms of 1D Schottky barrier between the MEG and the 2DEG. The gated structure exhibits on/off ratio up to $5 \times 10^6$ at room temperature. Various types of junction structures can also be produced on Si face (0001) of SiC, that involve single layer and structured graphene.

\textsuperscript{1}J. Kunc et al. \textit{Nano Lett.} 14, 5170-5175 (2014)