Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Graphene-on-GaN Hot Electron Transistor[1] AHMAD ZUBAIR, AMIRHASAN NOURBAKHSH, JIN-YONG HONG, YI SONG, Massachusetts Institute of Technology, MENG QI, University of Notre Dame, DEBDEEP JENA, Cornell University, JING KONG, MILDRED S. DRESSELHAUS, TOMAS PALACIOS, Massachusetts Institute of Technology — Hot electron transistors (HETs) are promising devices for potential high-frequency operation that currently CMOS cannot provide. In an HET, carrier transport is due to the injection of hot electrons from an emitter to a collector which is modulated by a base electrode. Therefore, ultra-thin base electrodes are needed to facilitate ultra-short transit time and high performance for THz operation range. In this regard, graphene, the thinnest conductive membrane in nature, is considered the best candidate for the base material in HETs. The existing HETs with SiO_2/Si as emitter stack suffer from low current gain and output current density. In this work, we use the two-dimensional electron gas (2-DEG) in a GaN-based heterostructure as emitter and monolayer graphene as the base electrode. The transport study of the proof-of-concept device shows high output current density (>50 A/cm^2), current gain (>3) and ballistic injection efficiency of 75%. These results indicate that performance parameters can be further improved by engineering the band offset of the graphene/collector stack and improved interface between graphene and GaN.

[1]Army Research Office (ARO) (Grant Nos. W911NF-14-2-0071, 6930265, and 6930861)

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Date submitted: 11 Nov 2016 Electronic form version 1.4