Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Electron transport in reduced graphene oxides in high electric field. WEN-BIN JIAN, JIAN-JHONG LAI, SHENG-TSUNG WANG, RUI-WEN TSAO, MIN-CHIA SU, WEI-YU TSAI, BARUCH ROSENSTEIN, Department of Electrophysics, National Chiao Tung University, Hsinchu, Taiwan, XUFENG ZHOU, ZHAOPING LIU, Ningbo Institute of Material Technology and Engineering, Chinese Academy of Science, Ningbo, PR China — Due to a honeycomb structure, charge carriers in graphene exhibit quasiparticles of linear energy-momentum dispersion and phenomena of Schwinger pair creation may be explored. Because graphene is easily broken in high electric fields, single-layer reduced graphene oxides (rGO) are used instead. The rGO shows a small band gap while it reveals a graphene like behavior in high electric fields. Electron transport in rGO exhibits two-dimensional Mott's variable range hopping. The temperature behavior of resistance in low electric fields and the electric field behavior of resistance at low temperatures are all well explained by the Mott model. At temperatures higher than ˜200 K, the electric field behavior does not agree with the model while it shows a power law behavior with an exponent of 3/2, being in agreement with the Schwinger model. Comparing with graphene, the rGO is more sustainable to high electric field thus presenting a complete high-electric field behavior. When the rGO is gated away from the charge neutral point, the turn-on electric field of Schwinger phenomena is increased. A summary figure is given to present electric field behaviors and power law variations of resistances of single-layer rGO, graphene, and MoS_2.

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Date submitted: 12 Nov 2016 Electronic form version 1.4