Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Giant Current-Perpendicular-to-Plane Magnetoresistance in Multilayer-Graphene Grown on Nickel SRIKRISHNA BODEPUDI, ABHAY SINGH, SANDIPAN PRAMANIK, University of Alberta — Magnetoresistance (MR), the change in electrical resistance as a function of an external magnetic field, is a key effect in magnetic field sensors. Ferromagnet-nonmagnet multilayers which often exhibit giant magnetoresistance or tunnel magnetoresistance effects are traditionally used to realize magnetic field sensors. MR in graphitic systems has drawn significant attention in recent years due to the unique crystal structures of these materials. In this work we explore another class of layered structure in which multilayer graphene (MLG) is as-grown on nickel substrate by chemical vapor deposition (CVD). We observed a large negative current-perpendicular-to-plane (CPP) MR ($>10^4$ %) in this system when the magnetic field is normal to the plane. The observed effect can be qualitatively explained within the framework of interlayer MR. Graphene layers in CVD-grown MLG are generally weakly coupled, which can be viewed as a stack of two dimensional Dirac electron system. A large negative interlayer MR can be expected in CPP geometry when the charge transport occurs between the zero mode Landau levels of weakly coupled Dirac electron system. This effect is stronger when the magnetic field is normal to the plane. We also showed that the defect free graphene is essential in addition to the weakly coupled graphene layers to observe the large negative MR. Due to large MR value and its persistence at room temperature, this effect is expected to have commercial implications and encourage further research on MLG physics.

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Date submitted: 14 Nov 2013 Electronic form version 1.4