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Thermoelectric and Magnetothermoelectric Transport Measurements of Graphene YURI M. ZUEV, Applied Physics, Columbia University, WILLY CHANG, PHILIP KIM, Physics, Columbia University — We investigated the electronic, thermoelectric, and magnetothermoelectric transport properties of graphene as a function of temperature and carrier density. Microfabricated heater and thermometer electrodes were used to simultaneously measure conductance and thermoelectric power (TEP) of graphene in the temperature range of 4-300K. Graphene exhibits both positive and negative values of TEP, with a peak value on the order of kB/e, when the Fermi energy is below and above the charge neutrality point, respectively. A quantitative comparison of the conductance and TEP can be made using the semiclassical Mott relation. We observed an excellent quantitative agreement between the measured TEP and the Mott relation based on the mesoscopic two terminal conductance in the low temperature regime ($T < 30K$). At higher temperatures, the Mott relation employing the local conductivity is necessary. Upon applying magnetic field, the magneto-thermopower exhibits characteristic oscillations in accordance with the Shubnikov-de Hass oscillations in conductance. In the quantum Hall regime at high B field, we observed the quantizing transverse and longitudinal thermpower components which are also in good agreement with the generalized Mott relation, except near the charge neutral Dirac point.

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