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The exploration of bandgap opening in graphene oxides by electrical measurements[1] WEN-BIN JIAN, SHENG-TSUNG WANG, YEN-FU LIN, PEI-CHING YEH, BARUCH ROSENSTEIN, Department of Electrophysics, National Chiao Tung University, Hsinchu, Taiwan, A. TORGEMAN, Department of Physics, Ariel University, Ariel, Israe, LAIN-JONG LI, Institute of Atomic and Molecular Sciences, Academia Sinica, Taipei, Taiwan, XUFENG ZHOU, ZHAOPING LIU, Ningbo Institute of Material Technology and Engineering, Chinese Academy of Science, Ningbo, PR China — Chemical or electrochemical exfoliation with post reduction is a vital, mass-production method to make few-layer graphene or reduced graphene oxides (rGOs). It was argued that several structures, including C-O-C and C-OH groups, are formed at graphene surface. The rGO flakes are reduced by hydrazine or thermal annealing whereas a small ratio of residue graphene oxides remains on surface. Unlike the metallic graphene, graphene oxides and rGOs show a bandgap with low conductivity. Several atomic models of rGOs were proposed but lacking experimental corroborations. We prepared rGOs with different ratios of remaining oxides. Two ohmic contacts and one tunneling junction were fabricated on each flake. The oxygen coverage, decided by the resistivity of rGO flakes, is in the range from 8 to 23%. Electron transport was studied from measurements of R-T data and fitted to two-dimensional Mott's variable range hopping. The tunneling junction and differential conductance measurements disclosed the density of states (DOS) in rGO flakes. Both transport and DOS measurements indicate an electronic phase transition at an oxygen coverage of 15%. The DOS variation and bandgap opening are reproduced from theoretical calculation.

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