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The influence of selective chemical doping on clean, low-carrier density SiC epitaxial graphene[1] CHIASHAIN CHUANG, YANFEI YANG, National Institute of Standard and Technology, LUNG-I HUANG, CHI-TE LIANG, National Taiwan University, RANDOLPH E. ELMQUIST, National Institute of Standard and Technology, NATIONAL INSTITUTE OF OF STANDARDS AND TECHNOLOGY COLLABORATION, NATIONAL TAIWAN UNIVERSITY, DEPARTMENT OF PHYSICS COLLABORATION — The charge-transfer effect of ambient air on magneto-transport in polymer-free SiC graphene was investigated. Interestingly, adsorption of atmospheric gas molecules on clean epitaxial graphene can reduce the carrier density to near charge neutrality, allowing observation of highly precise $v = 2$ quantum Hall plateaus. The atmospheric adsorbates were reproducibly removed and pure gases (N_2, O_2, CO_2, H_2O) were used to form new individual adsorbates on SiC graphene. Our experimental results ($\tau_t/\tau_q \approx 2$) support the theoretical predictions for the ratio of transport relaxation time τ_t to quantum lifetime τ_q in clean graphene. The analysis of Shubnikov-de Haas oscillations at intermediate doping levels indicates that the carrier scattering is reduced by water and oxygen so as to increase both the classical and quantum mobility. This study points to the key dopant gases in ambient air and also paves the way towards extremely precise quantized Hall resistance standards in epitaxial graphene systems with carrier density tuned by exposure to highly pure gases and vacuum annealing treatment.

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