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Coupled Chemisorption and Physisorption of Oxygen on Single Layer Graphene Devices[1] HUA WEN, ADRIAN SWARTZ, DANTE O'HARA, PATRICK ODENTHAL, JEN-RU CHEN, Univ of California - Riverside, ROLAND KAWAKAMI, Ohio State University and Univ of California - Riverside — We investigate adsorption of molecular oxygen on single layer graphene devices and demonstrate that chemisorption of molecular oxygen at low temperatures is strongly coupled to the physisorption process. Through low temperature adsorption and variable-temperature desorption studies, we establish the ability to use electrical measurements to separately identify the physisorption and chemisorption of oxygen on graphene: chemisorption is identified by a change in Dirac point voltage, while physisorption is identified through its increase of the mobility. By utilizing the electrostatic gate controlled chemisorption, we demonstrate that the chemisorption at low temperatures is driven by a two-step process in which free oxygen molecules are first captured onto graphene by physisorption, and then the oxygen undergoes a physisorption-to-chemisorption conversion. Our study provides a better understanding of the effect of gas adsorbates on graphene and could be useful in future applications of graphene-based gas sensors.

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