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Three Different Translations Can Each Convert the Top Plane of Graphite to Graphene[1] D. QI, P. XU, Y. YANG, M.L. ACKERMAN, S.D. BARBER, J.K. SCHOELZ, L. BELLAICHE, SALVADOR BARRAZA-LOPEZ, P.M. THIBADO, Department of Physics, University of Arkansas, IGOR A. KORNEV, Proprietes et Modelisation des Solides, France — The discovery of graphene, a unique two-dimensional electron system with extraordinary physical properties, has ignited tremendous research activity in both science and technology. Graphene can be obtained from graphite by moving its top layer until it becomes locally decoupled from the bulk. However, a detailed microscopic understanding of this process has yet to be completed. Here we present STM images of the top plane of graphite, which has been transformed into graphene. In addition, we also present STM images which reveal several intermediate stages in between pure graphene and pure graphite. Density functional theory was used to simulate STM images from a six-layer slab of graphite. We also moved the top layer of graphite incrementally in three different directions. Vertical movement of the top layer by about 0.1 nm created graphene. A continuous transition from pure graphite to pure graphene was observed with the simulations. Horizontal movement of the top layer can also create graphene in two ways. In one configuration, the carbon atoms perfectly align with the layer below, while in the second the carbon atoms have no vertical alignment with the layer below. Other significant details found between graphite and graphene will be discussed.

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