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A subnanometer view of the chemistry and electronic structure of graphene and graphite

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We have used UHV, low and variable temperature Scanning Tunneling Microscopy (STM) to investigate the structure and electronic properties of single sheets of graphite (graphene) on both insulating and metallic surfaces. STM as well as Scanning Tunneling Spectroscopy reveal variations in electron tunneling images for these one atom thick samples that differ markedly from those of ordinary, multi-layer graphite. These kinds of investigations have been extended to the study of surface chemical reactions where the Scanning Tunneling Microscope/Atomic Force Microscope is used as a “camera” to observe defect growth in single and multiple graphene sheets due to treatment with oxygen. “Healing” of defects in ordinary graphite has also been observed in samples exposed to acetylene at elevated temperatures using STM. The chemistry on these model surfaces is expected to reveal many features that determine the nanoscale properties of graphene.