Direct observation of graphene destruction and reconstruction by in situ TEM

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Graphene is viewed as an ideal two dimensional (2D) atomic crystal with supreme physical properties to replace present electronic and spintronic materials. Meanwhile, less-than-perfect versions of graphene, i.e. derivatives with functional groups and specific edges or defects, offer opportunities in chemical catalytic applications. Effective control of these imperfections for targeted applications is still challenging in graphene engineering. In this study, direct observation of graphene defects forming, healing and new layer growth in ionized carbonate under vacuum have been performed by in situ transmission electron microscope (TEM). The ionized carbonate works as chemical scissors and weaver. This work not only provides an efficient and facile method on graphene cutting, but also sheds light on converting greenhouse gas to graphene. Defects management of graphene and its analogous is appealing to the community pursuing metal-free catalysis, and the feasible CO_2-to-graphene conversion to renewable energy.

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