

Study on Grain Boundaries in Single-layer Graphene Using Ultrahigh Resolution TEM

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Recently, large-area synthesis of high-quality but polycrystalline graphene has been advanced as a scalable route to applications including electronic devices. The presence of grain boundaries (GBs) may be detrimental on some electronic, thermal, and mechanical properties of graphene, including reduced electronic mobility, lower thermal conductivity, and reduced ultimate mechanical strength, yet on the other hand, GBs might be beneficially exploited via controlled GB engineering. The study of graphene grains and their boundary is therefore critical for a complete understanding of this interesting material and for enabling diverse applications. I present that scanning electron diffraction in STEM mode makes possible fast and direct identification of GBs. We also demonstrate that dark field TEM imaging techniques allow facile GB imaging for high-angle tilt GBs in graphene. GB mapping is systematically carried out on large-area graphene samples via these complementary techniques. The study of the detailed atomic structure at a GB in suspended graphene uses aberration-corrected atomic resolution TEM at a low kV.