Electron-Beam Induced Atomic Scale Defects in 2D Materials at Elevated Temperatures Using In Situ Transmission Electron Microscopy

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Transmission Electron Microscopy (TEM) is a powerful tool for probing structures at the nanoscale. Recent advancements in aberration corrected TEM instruments have improved this technique to achieve atomic scale resolution (0.5Å). Additionally, new progress has led to *in situ* imaging with temperature control, electrical biasing, and liquid samples. Here, we utilize atomic resolution transmission electron microscopy with *in situ* temperature control up to 1000°C to study 2D nanomaterials.

Two dimensional nanomaterials such as graphene exhibit exciting properties including high mechanical strength, transparency, and high electron mobility.[1] This has attracted much interest for applications in touch screens, sensors, photovoltaics, and other electronic devices. Hexagonal boron nitride, a single layer sp^2 material that is structurally isoelectronic with graphene, has excellent thermal conductivity and resistance to oxidation leading to many promising applications in the aerospace, textile, medical, and electronics industries.[2,3] Synthesis of these materials can be achieved in a scalable manner using chemical vapor deposition.[4,5] However, due to their atomically thin structure, an understanding of their in-plane defects is crucial to future applications.[6,7] In this study, we report on the structure of defects in hexagonal boron nitride at elevated temperature using *in situ* aberration corrected transmission electron microscopy. By changing the temperature during electron beam irradiation, we both induce and image atomic-scale defects with a variety of geometries.

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