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Imaging 2D materials to understand how they bend, stretch and twist

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Understanding the deformation and bending of two-dimensional (2D) materials is critical for the realization of next-generation electronics and nanomechanical devices. For example, while the mechanics of few-layer graphene have been studied for more than a decade, there is still no consensus on basic properties such as its bending stiffness and how it scales with thickness. In addition, defect and strain engineering of 2D materials is an emerging area of research, where homogeneous or heterogeneous alloying can stabilize exotic electronic phases such as Weyl semimetals or pattern the properties of 2D nanoelectronics and optoelectronics on the nanoscale. Electron microscopy provides a powerful platform for addressing these challenges by enabling measurements of the conformation and strain of 2D materials at atomic resolution. In this talk, I will discuss our work using aberration-corrected scanning transmission electron microscopy (STEM) in order to probe and quantify these deformations in 2D materials at the atomic scale. This work is divided into two areas: 1) using machine learning to expand the precision of atomic resolution STEM in order to visualize local picometer-scale strain fields and understand how single-atom defects interact with the surrounding lattice and 2) using STEM in combination with mechanical modeling to reveal an unusual, slip-mediated softening of graphene and other 2D materials. Our results indicate that the bending stiffness of few layer graphene can be orders of magnitude smaller than previously thought and provide a new lower limit for the fabrication of ultra-soft, high mobility electronic nanodevices based on 2D materials.

Für diese Zeit steht eine Kinderbetreuung nach vorheriger Anmeldung zur Verfügung.

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