

Electron microscopy observation of atomic structures and their evolutions in 2D and 1D materials

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Properties of low-dimensional material highly depend on its atomic structure. The studies of atomic defects and boundaries are of general interest for the fundamental researches and technological applications in any crystalline materials, especially in 2D materials. Point defects and edge structures of graphene have been intensively studied with atomic precision in the last decade. Here I present some new examples for atomic-scale imaging and spectroscopy of various low-dimensional materials with interrupted periodicities. Nitrogen defects and their chemical dynamics of graphene are now studied at individual atom basis [1]. Defects and phase transitions of single-layered dichalcogenides (MX_2) are corroborated *in situ* [2]. In plane anisotropy of single-layered group VII dichalcogenides (ReS_2 and ReSe_2) is recently reported [3]. Also various new 1D structures inside carbon nanotubes are discovered and investigated [4, 5, 6]. Eventually single atom magnet at graphene atomic defects will be proposed [7].

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