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Engineering Monolayer Graphene Nanoribbons with Boron Nitride. RONG YANG, Institute of Physics, Chinese Academy of Sciences — Graphene nanostructures are potential building blocks for nanoelectronic and spintronic devices. However, the production of monolayer graphene nanostructures with high-quality and well-defined zigzag edges remains a challenge. In this talk, we report the engineering of electronic grade monolayer graphene nanostructures on hexagonal boron nitride (h-BN) substrates either by an top-down etching technique or by an bottom-up growth way. As for the top-down way, we found that hydrogen plasma etching of monolayer graphene on h-BN is highly anisotropic due to the inert and ultra-flat nature of the h-BN surface, resulting in zigzag edge formation. The as-fabricated zigzag-edged monolayer graphene nanoribbons with widths below 30 nm show high carrier mobility (2000 cm^2/ Vs, with on/off ratio of $>10^2$) and width-dependent energy gaps at liquid helium temperature. Besides, we can also obtain monolayer graphene nanoribbons (GNRs) on h-BN by a bottom-up epitaxy growth. We found that GNRs grow preferentially from the atomic steps of h-BN, forming in-plane heterostructures. As-grown GNRs on h-BN have high quality with a carrier mobility of ˜20000 cm^2/ Vs for 100-nm-wide GNRs at a temperature of 1.7 K. More interesting, a moire pattern induced quasi-one-dimensional superlattice with a periodicity of 15nm for GNR/h-BN was also observed, indicating zero crystallographic twisting angle between GNRs and h-BN substrate. The superlattice induced band structure modification is confirmed by our transport results.

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