INTRINSIC ELECTRONIC PROPERTIES OF HONEYCOMB METAL-ORGANIC NETWORK

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Two-dimensional (2D) metal-organic frameworks (MOFs) have been proposed as a playfield by many theoretical groups for studying exotic electronic states such as topological insulators and flatband ferromagnets [1-3]. I will present experimental realization and measurement of the intrinsic electronic properties of 2D honeycomb MOFs grown on graphene/Ir(111) surface studied using low-temperature scanning tunneling microscopy and spectroscopy (STM/STS). The MOF synthesized using 4,4-biphenyldicarbonitrile molecules and cobalt metal atoms grows in a striped phase at room temperature where Co centers show four-fold coordination. After high temperature annealing, the structure transforms into honeycomb phase with a three-fold coordination of the cobalt centers. The interfacial graphene layer decouples the MOF from the underlying substrate allowing its intrinsic electronic properties to be probed. STS reveals that the highest occupied states are localized on the metal center, while the lowest unoccupied states are located on the molecules for both phases. The understanding of intrinsic electronic properties of MOFs will help us to realize quantum materials with exotic electronic properties and design novel devices for applications in dissipationless electronics, spintronics, and optoelectronics.

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