Team calculates the electronic transport properties of graphene stacks

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Anticipating forthcoming experiments, a CNST team has shown that few layer graphene stacks have favorable transport properties that could enable engineering of novel electronic devices.

There has been significant research examining the properties of monolayer graphene, single sheets of carbon atoms that can be extracted from bulk graphite. However, the same extraction techniques can also make few-layer-thick stacks of graphene sheets.

In this work, the CNST team calculated how the number of sheets and their relative orientation affects the multilayers'electrical conductivity.

In the most energetically favorable case, where half of the carbon atoms on neighboring layers share the same x-y position, the researchers predicted that stacks of three or four sheets should not behave like bulk graphite, but rather like a collection of monolayer and bilayer graphene sheets.

In their calculations, these high-symmetry stacking arrangements exhibited properties particularly promising for future electronics, including a carrier mobility that was higher than that of either a graphene monolayer or bilayer with the same impurity concentration.

The calculations also found that if the stacks were sufficiently pure (comparable to the cleanest graphene monolayers reported in the literature), a transport measurement could be used to identify the

number of layers, the stacking orientation, and whether the dominant disorder was due to short-range causes, such as missing atoms, or long-range causes, such charged adsorbates.

More information: Semiclassical Boltzmann transport theory for graphene multilayers, H. Min, P. Jain, S. Adam, and M. D. Stiles, *Physical Review B* 83, 195117 (2011). prb.aps.org/abstract/PRB/v83/i19/e195117

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