Effect of the intercalation of graphite in a metal/graphene contact

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In order for graphene and other two-dimensional materials to become competitive, one of the main technological hurdles that must be overcome is achieving a low contact resistance (Rc) [1]. For graphene, it is often quoted that an Rc value lower than 100 Ω·μm is desirable, while larger values are thought to be a limiting factor on the graphene field effect transistor performance [2,3].

On the other hand, electron passage from graphite into graphene will suffer the minimum amount of disturbance. Thus, it is conceivable that a graphite/graphene junction would present a significantly low contact resistance. Some experimental observations point along that direction [4], while in another occasion a graphite/graphene contact has proven superior to using Cr/Au as the electrode [5].

We present results computing, from first principles, the ballistic conductance of a graphene on graphite contact where (a) graphene infinitely extends over the graphite substrate, and (b) graphene has a finite overlap with the graphite substrate (Fig. 1).

Of course, in real devices graphite would eventually contact some metal in order to decrease electrode resistance. We will also address this, computing the conductance and contact resistance of a metal/graphite/graphene structure, and comparing them to the values obtained for the corresponding structures without graphite.

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References

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Figures

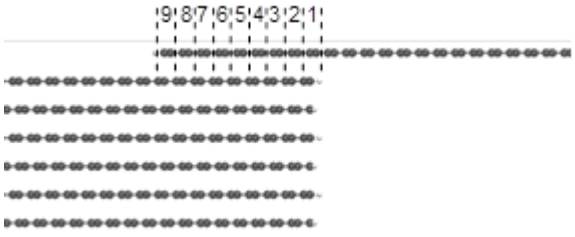

Figure 1: Structure of the graphene on graphite contact with a varying finite amount of overlap.

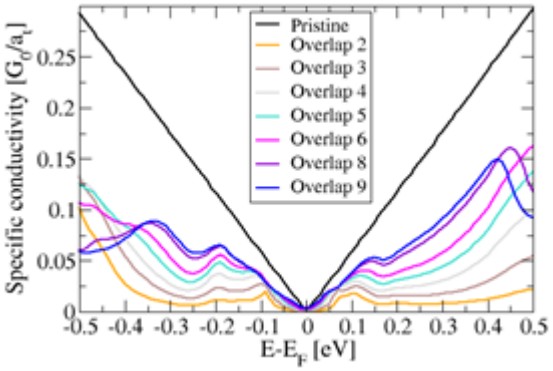

Figure 2: Specific conductivity for the various amounts of overlap.