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Electronic structure and localization behavior of hydrogenated graphene[1] JUNHYEOK BANG, K. J. CHANG, Department of Physics, Korea Advanced Institute of Science and Technology — Graphene, i.e., a single layer of graphite, has attracted much attention because of its unique electronic properties such as zero gap and massless Dirac fermions. More interestingly, this system remains metallic even in the presence of long range disorders. Delocalization of carriers is attributed to the absence of back scattering. Recently, it was reported that graphene undergoes a metal-to-insulator transition by hydrogenation. However, its origin is not clearly understood yet. Here we study the electronic and transport properties of hydrogenated graphene through first-principles and tight-binding calculations. When H atoms bond randomly to only the C atoms in the A sublattice, the band gap is developed, with nearly degenerate impurity levels lying at the Dirac point. If H atoms are randomly adsorbed at both the A and B sublattice sites, the impurity band with a finite width is formed near the Dirac point due to interactions between the impurity levels. In the latter case, we find that conductance decays exponentially with increasing of the sample size, following the single parameter scaling theory of Anderson localization.

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