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Enhanced quantum coherence in graphene caused by Pd cluster deposition and its zero-temperature saturation FENGQI SONG, JUNHAO HAN, BAIGENG WANG, GUANGHOU WANG, Nanjing Univerisity, NANJING TEAM — The surface decoration of graphene offers great opportunities because graphene is a fully open system. Functional defects, p/n type doping, spin polarization, and additional spin–orbit interactions can be introduced when atoms are absorbed from an external source. Researchers are even considering inducing topologically nontrivial gaps inside the Dirac cone. Despite the potential advances, however, an important problem remains that surface absorption, along with introducing the required functionality, induces additional electronic scattering Such scattering may suppress the coherence of the Dirac fermions and may even disable these desired quantum states. Here we report on the unexpected increase of the dephasing lengths of a graphene sheet caused by the deposition of Pd nanoclusters, demonstrated by weak localization measurements. The dephasing lengths reached saturated values at low temperatures, essentially related to zero-temperature dephasing. The temperature-dependent dephasing was described by 1/(TlnT) and the saturated dephasing period was found to depend on σle. This reveals disorder-induced zero-temperature dephasing in our defect-enriched graphene. Combined with theoretical calculations, we suggest that competition between surface scattering and charge transfer leads to the improvement of quantum coherence in cluster-decorated graphene. (in review)

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