Effect of Temperature and Magnetic Field on Spin Relaxation in Trilayer Graphene: A Monte Carlo Simulation Study

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Abstract

In this work, we have used semi-classical Monte Carlo simulations for modeling spin transport in trilayer graphene (TLG) with ABA (Bernal) and ABC stacking. We have taken into consideration the D'yakonov–Perel (DP) and the Elliot–Yafet (EY) mechanisms of spin relaxation for modeling purposes. The two different stacking orders have different band-structures. We study the effect of electron electron (e-e) scattering, temperature and external magnetic field on spin relaxation length (SLG) in ABA and ABC stacked TLG. We have considered injection polarization along the z-direction which is perpendicular to the plane of graphene and the magnitude of ensemble averaged spin variation is studied along the x-direction which is the transport direction. We found that SRL is higher in the case of ABC stacking because of low scattering rates as compared to ABA stacked TLG. When e-e scattering is included we found that SRL in ABA stacked TLG decreases by 48% while in ABC TLG it decreases by only 14% at 4K. The spin relaxation length decreases by about 43% for ABA stacked TLG and 58.6% for ABC stacked TLG at 300K as compared to the SRL at 4K. This theoretical investigation is important in order to identify the factors responsible for experimentally observed spin relaxation length in TLG.

References

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3. C. Jacoboni and L. Reggiani: Rev. Mod. Phys. 55(1983)645.

Figures

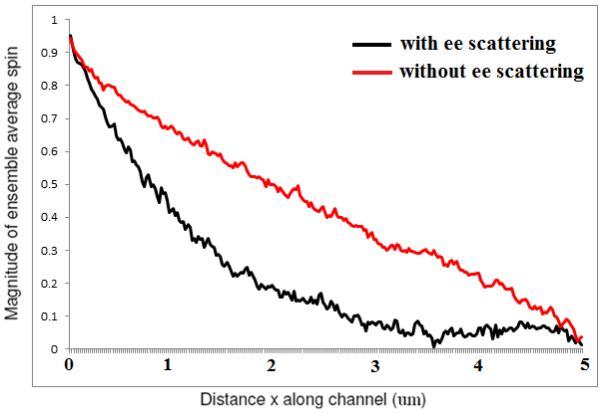

Figure 1. Decay of magnitude of ensemble averaged along ABA trilayer at 4K for driving electric field of 1kV/cm spin along ABC trilayer at 4K for driving electric field of 1kV/cm.

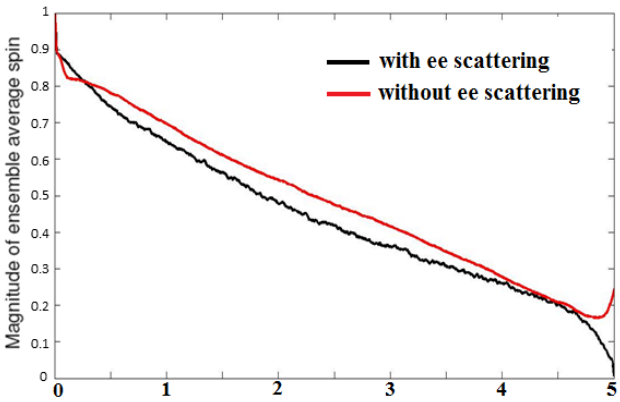

Fig 2. Decay of magnitude of ensemble averaged spin along ABC trilayer at 4K for driving electric field of 1kV/cm