Electrical and magnetic properties of graphene/graphene oxide heterostructure fabricated by chemical modification

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In the past decade, the study of graphene has been tremendously exploited due to its phenomenal physical and electromagnetic properties such as high flexibility, high thermal conductivity, high electron mobility and long spin diffusion length. Especially, research using long spin life-time and spin diffusion length of graphene have been extensively investigated for the application to spintronics. However, low spin-injection efficiency (~1%) of graphene is an obstacle to realize for spintronic devices. Recently, there have been reports to overcome this problem by using insulating oxide films or a material which has a similar hexagonal lattice constant of graphene such as Ni (111) between the ferromagnetic electrode and graphene.[1] Also, it has been known that a magnetic exchange field (MEF) induced by a magnetic insulator adjacent to graphene can effectively control local spin generation and spin modulation in a 2D device without modulating the structural properties of the material.[2]

In this study, we fabricated graphene (G) / graphene oxide (GO) junction devices in which GO was formed by oxidation technique by applying ultraviolet(UV) light, directly. One of the shortcut to fabricate large area GO, which can make the process of fabrication device easy, minimizing contamination on graphene surface is using ozone induced by UV light.[3] We examined the proximity effect of GO adjacent graphene in the transport of this G/GO heterostructure device with external magnetic field. We showed that week localization and Shubinikov-de Haas oscillations were larger than that of pristine graphene. And we measured magnetoresistance(MR) that revealed negative MR at low temperature in this G/GO heterostructure device. We expect the ferromagnetic properties of GO improve the spin-orbit coupling of the graphene.

References

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