Contribution (Invited)

Tailoring magnetic graphene proximity coupled to ferromagnetic insulators

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The recent discovery of the quantum anomalous Hall effect (QAHE) in magnetically doped topological insulators in the milikelvin regime represents breakthrough in the field of spintronics[1]. Theoretically, the QAHE should occur in graphene proximity coupled to a ferromagnetic insulator[2] but with the promise of much higher operating temperatures for practical applications. Hints of proximity-induced magnetism in graphene coupled to yttrium iron garnet (YIG) films have been reported[3] although the QAHE remains unobserved; the lack of a fully developed plateau in graphene/YIG devices can be attributed to poor interfacial coupling and therefore a dramatically reduced magnetic proximity effect

Here we report the deposition and characterisation of epitaxial thin-films of YIG on lattice-matched gadolinium gallium garnet substrates by pulsed laser deposition. YIG films are characterized by X-ray diffraction, atomic force microscopy vibrating sample magnetometry and ferromagnetic resonance in order to check is quality. Pristine exfoliated graphene flakes coupled to transition metal dichalcogenides are transferred mechanically onto the YIG. The induced magnetization of the 2D-like heterostructure is reported by means of electrical (low temperature magnetoresistance measurements in Hall-bar-like configuration) measurements The results correlate the effects of YIG morphology on the electronic properties and magnetization of graphene.

References

[1] C.Z. Chang et al., Science **340**, 167 (2013) and C.Z. Chang et al., Nature Materials **14**, 473 (2015).

[2] C. L. Kane and E. J. Mele, Phys. Rev. Lett. **95**, 226801 (2005).

[3] Z. Wang et al., Phys. Rev. Lett. **114**, 016603 (2015).

Figures

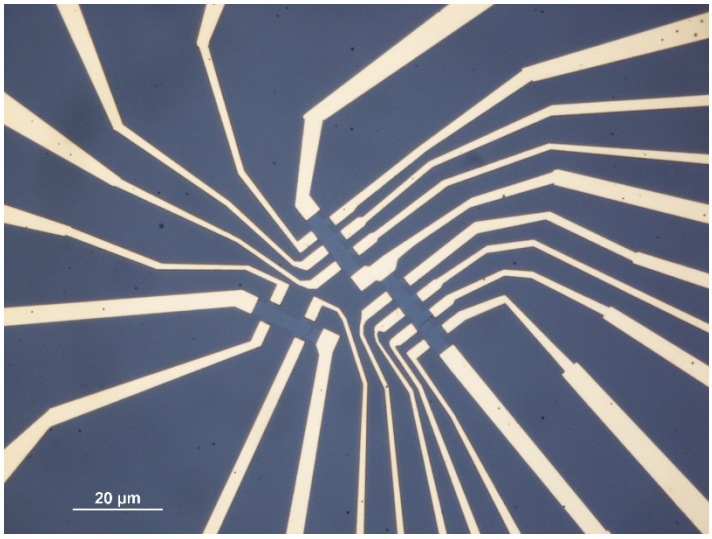

Figure 1: Electron micrograph of three h-BN-encapsulated graphene flakes in a Hall-bar-like configuration deposited on YIG.