Room temperature long distance spin transport in chemical vapor deposited graphene

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Abstract

Graphene is an ideal spin transport medium for efficient spintronic devices. Since the first report of spin transport and precession in graphene [1], the graphene spintronics' community has been able to achieve impressive progress in enhancing the spin lifetime and diffusion length in exfoliated graphene [2]. Such exfoliated flakes are limited in size and hence are unsuitable for large scale practical applications. Spin transport studies in wafer scale chemical vapor deposited (CVD) graphene have revealed relatively lower spin parameters (with spin lifetime ~ 100-200 ps) [3,4]. In this work, we report a very high spintronic performance of large area chemical vapor deposited (CVD) graphene on SiO_2 substrate at room temperature [5]. Through non-local pure spin transport and precession measurements, we demonstrate spin communication over channel lengths extending up to 16 μm with a spin lifetime of 1.2 ns and a spin diffusion length ~ 6 μm at room temperature (Fig. 1). These spin parameters are not only up to six times higher than previous reports on CVD graphene, but are also the highest at room temperature for any form of pristine graphene on standard SiO_2/Si substrates. Our detailed investigations involving various graphene channel lengths, carrier densities and temperatures demonstrate the observed performance over a wafer scale. These results elucidate that CVD graphene is an excellent material for long distance spin communication in possible future graphene channel based memory and logic applications.

References

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