Spin-Orbit Coupling Enhancement in Weakly Hydrogenated Graphene

Dr Barbaros Özyilmaz

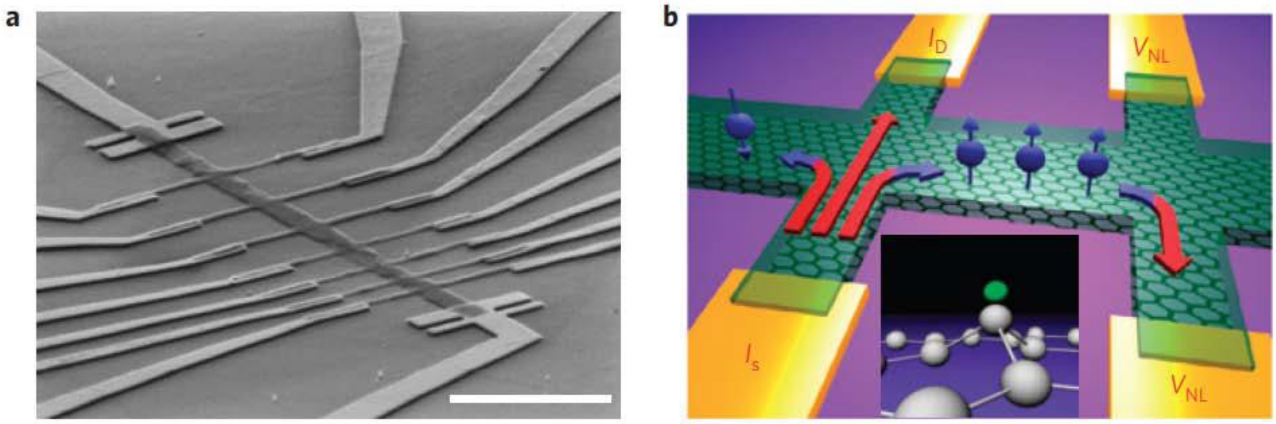
Department of Physics

Graphene Research Centre

Graphene holds considerable promise for novel applications in spintronics and quantum information processing because it has a high degree of electron mobility and gate tunability. Yet it also suffers from inherent drawbacks. For example, its lack of an energy band gap limits its capacity to be used in conventional charge-based semiconductor devices, and its extremely small spin-orbit (SO) interaction means that graphene-based Spin Hall Effect (SHE) devices are practically impossible.

What is urgently needed is a means of dramatically enhancing graphene's small SO interaction while retaining its exceptional high-charge mobility. In a significant research breakthrough, Asst Prof Dr Barbaros Özyilmaz of the Department of Physics and his team overcame these challenges using hydrogen silsesquioxane, a negative tone electron beam resist, thereby limiting the hydrogenation rate to very low values. With virtually unchanged charge conductivity, the SO interaction of the graphene increases by two orders of magnitude.

This is a significant development that will finally allow the production of devices in which spin currents can be generated without the use of ferromagnetic leads. These currents will instead be generated from charge currents via the SHE. The major applications for this significant breakthrough will be graphene-based room temperature spin-FETs and flexible spintronics applications, thereby enlivening the currently stagnant field of spintronics and opening it up to the wider graphene community.



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