Ultrafast spin dynamics in graphene-ferromagnet interfaces

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Graphene is an extraordinary material for electronic charge and spin transport, which makes it ideal for spintronic applications[1], and it presents a novel pathway for the exploration of ultrafast graphene spintronics. Metal oxides and ferromagnets form key components of graphene spintronic systems. While metal oxide layers serve as tunnel barriers for efficient spin-polarized tunneling and non-invasive surface charge transfer doping in graphene[1,2], controlling ultrafast spin dynamics in ferromagnets can enable new spintronic and magnonic applications[3]. In particular, ferromagnet interfaces with graphene reveal striking properties[4,5]. In this work, we fabricate graphene-ferromagnetic interfaces with and without oxide tunnel barriers and investigate how such graphene heterostructures can lead to the control of ultrafast spin currents electrically at graphene-ferromagnet junctions. These studies show how interfaces with oxide layers lead to changes in ultrafast spin dynamics in graphene ferromagnet interfaces. Finally, our experiments reveal that doping control of graphene can significantly impact ultrafast spin dynamics. These results provide new ways to influence the growing research and technological fronts in two-dimensional ultrafast spintronics.

References

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