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Spin relaxation mechanism in graphene spin valves with Al_2O_3 and MgO tunnel barriers[1] WALID AMAMOU, ZHISHENG LIN, JEREMIAH VAN BAREN, JING SHI, UC Riverside, ROLAND KAWAKAMI, Ohio State University — Contact induced spin relaxation in graphene lateral spin valves is one of major limiting factors for obtaining long spin lifetimes in graphene. There are various spin relaxation mechanisms, including spin absorption, interfacial spin scattering, and fringe field effects, which may account for the observed short spin lifetimes. One possible solution is to introduce a tunnel barrier between graphene and the ferromagnetic electrode, which should reduce contact induced spin relaxation and allow for longer spin lifetimes. We study the spin relaxation mechanisms in our graphene spin valves with two different types of tunnel barriers, aluminum oxide and MgO/TiO_2 using the standard non-local measurement geometry. To extract the spin lifetime from Hanle spin precession data, we perform fits based on Bloch equation models that include the effects of spin absorption into the magnetic contacts. We observe a strong dependence of the extracted spin lifetime on the resistance-area (RA) product of the contacts. To understand the role of spin absorption, we compare these results to fits obtained using Hanle models that do not take spin absorption into account. Analysis shows that spin absorption might not be the dominant source of contact induced spin relaxation for graphene spin valves with sputtered Al_2O_3 and MgO/TiO_2 barriers. Interfacial spin-flip scattering or spin dephasing resulting from local magnetostatic fields due to contact roughness are likely to be more important.

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