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Spin filtering in graphene based magnetic tunnel junctions

The discovery of graphene has opened novel exciting opportunities in terms of functionalities and performances for spintronics devices. To date, it is mainly graphene properties for efficient in-plane spin transport which have been put forward. We will present here experimental results concerning integration of graphene in vertical Magnetic Tunnel Junctions. We will show that a thin graphene passivation layer, directly integrated by low temperature catalyzed chemical vapor deposition (CVD) [1][2], allows to preserve a highly surface sensitive spin current polarizer/analyzer behavior and adds new enhanced spin filtering property. The graphene layer prevents the oxidation of the ferromagnet enabling the use of novel processes for spintronics devices.[3][4] We will illustrate this property by demonstrating the use of ozone based ALD processes to fabricate efficient spin valves protected with graphene. Characterizations of complete spin valves making use of graphene grown by CVD will then be presented. We will discuss the measured experimental spin signals in light of bulk band structure spin filtering effect as usually observed with MgO [1][3][4], but also highlight the role of interfacial hybridization for spin selection (a.k.a spinterface) with ab-initio calculations in support.[5] We will further discuss these observed spin filtering effects by analyzing results with other 2D materials (such as h-BN and WS_2) integrated in MTJ devices. The different presented experiments unveil promising uses of 2D materials for spintronics.

References

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