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Modeling the negative magnetoresistance of Ferromagnet-Graphene-Ferromagnet junctions OLAF VAN T ERVE, ENRIQUE COBAS, BEREND JONKER, Naval Research Lab, - TEAM — Ferromagnet – multilayer graphene – ferromagnet junctions are predicted to yield low resistance devices with a high magnetoresistance (MR) due to a metallic minority spin transport channel [1]. We fabricated arrays of such junctions via chemical vapor deposition of graphene on lattice-matched single-crystal NiFe(111) films with a bcc-Fe top contact. The junctions exhibit negative MR and metallic transport behavior attributed to minority spin filtering, and low resistance. Existing models fail to predict the negative MR observed in our metallic junctions. Here we develop a model based on the Mott two spin current approximation where the two spin channels are treated independently. The model incorporates spin current conversion, the minority spin filtering predicted for the high quality lattice matched NiFe(111) /graphene interface, as well as a diffusive interface for the graphene / e-beam deposited bcc-Fe layer that is not expected to result in spin filtering. This model correctly predicts the observed negative MR and gives a lower bound for the minority spin polarization, exceeding 80% at low temperatures, for junctions that exhibit an MR of -12% at 10K. The model quantitatively predicts the dependence of the MR on the RA product at room temperature, and is consistent with the high minority spin polarization inside the graphene junction as predicted by Karpan. [1] Karpan, V. M. et al. *Phys. Rev. Lett.* 99, 176602 (2007).

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