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Inversion of Ferromagnetic Proximity Polarization in GaAs by MgO Interlayers Y. LI, Y. CHYE, Y.F. CHIANG, K. PI, W.H. WANG, Department of Physics and Astronomy, UC Riverside, J.M. STEPHENS, S. MACK, D.D. AWSCHALOM, Center for Spintronics and Quantum Computation, UC Santa Barbara, R.K. KAWAKAMI, Department of Physics and Astronomy, UC Riverside — Ferromagnet/semiconductor hybrid structures are building blocks for spin transport devices and spin-based logic gates for large- scale circuits. Recent experiments achieved success in making a lateral Fe/GaAs spin transport device, but anomalous bias dependence of the spin injection signal demand an understanding of the role of atomic-scale interfacial structure in determining the spin dependent reflection and transmission coefficients. In our studies, we incorporate a spin-filtering material MgO in the Fe/GaAs structure, and directly study the spin dependent reflection properties of the interface, or the ferromagnetic proximity polarization (FPP) effect, through ultrafast optical measurements. We find that the FPP in Fe/MgO/GaAs can be tuned by controlling MgO thickness, and we observe a sign change by MgO interlayers. Through study of the related nuclear spin polarization, we also observed sign change of FPP with laser intensity when MgO thickness is in the transition range of sign change. By modification of the interface, mainly changing oxygen partial pressure during MgO growth, we find that the Fe-Mg bond is a key factor in the sign change. Supported by CNID, ONR and NSF.

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