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Dynamically Decoupled Precession of Interfacial Electron Spins in Fe/AlGaAs (001) GUNTER LUEPKE, HAIBIN ZHAO, DIYAR TALBAYEV, College of William and Mary, AUBREY HANBICKI, CONNIE LI, BERRY JONKER, Naval Research Laboratory — We report on the coherent spin precession dynamics of the interface magnetization in Fe/AlGaAs (001) heterostructures using the time-resolved magnetization-induced second-harmonic generation technique, and compare these results with the bulk spin precession dynamics obtained by time-resolved magneto-optical Kerr effect. We have measured the frequency, phase and hysteretic behavior of the precession dynamics of the interface and bulk. Our results clearly show: (a) the coherent precession of the interface magnetization is decoupled from the bulk magnetization precession even at the picosecond time scale; (b) higher frequency spin precession occurs at the interface than in the bulk; (c) the phase of the interface spin precession is opposite to that of the bulk precession at low fields; and (d) the interface and bulk precession exhibit different hysteretic behavior. This is attributed to different magnetization switching processes and vanishingly small exchange coupling between the interface magnetization and the bulk Fe. The higher precessional frequencies observed at the interface for a given field indicate that higher speed performance can be realized in nanoscale magnetic devices where interface properties dominate.

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