Part I: Composition Controlled Spin Polarization in Co$_{1-x}$Fe$_x$S$_2$: Electronic, Magnetic, and Thermodynamic Properties

We demonstrated that alloy composition can be used to fine-tune the position of the Fermi level in Co$_{1-x}$Fe$_x$S$_2$ alloys leading to composition controlled spin polarization and the ability to engineer high conduction electron spin polarizations of up to 85%. We present here a comprehensive experimental investigation of the structure, stoichiometry, magnetic, magnetotransport, and thermodynamic properties of bulk polycrystalline solid solutions of Co$_{1-x}$Fe$_x$S$_2$ and single crystalline CoS$_2$. The experimentally determined spin polarization can be tuned by alloy composition between $-57\%$ ($x = 0$) and $+85\%$ ($x = 0.15$). The evolution of the magnetic, transport and thermodynamic properties with increasing Fe doping is discussed in terms of the composition dependence of the conduction electron spin polarization and the spin-dependent band structure.

Part II: Oscillating Exchange Bias in Fe/Cr Structure

We report clear multiple period oscillations in the temperature dependence of exchange bias in an Fe thin film exchange coupled to a neighboring Cr film. The oscillations arise due to an incommensurate spin density wave in the Cr, with wavevector perpendicular to the Fe/Cr (001) interface. The exchange bias and coercivity allow for a determination of the extent of the thermally-driven wavelength expansion, the (strain-suppressed) spin-flip transition temperature, and the Cr Néel temperature, which show a crossover from bulk-like to finite-size behavior at a Cr thickness of ~ 1100 Å. The data are consistent with a transition from a transverse to longitudinal on cooling.

**Date:** Wednesday, 31 January 2007  
**Time:** 11.30am to 12.30pm  
**Venue:** PAP Meeting Room (SBS B3n-19)