Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

**Soft magnetic layers for low-field detection in spin-valve and magnetic-tunnel-junction sensors** WILLIAM EGELHOFF, ROBERT MCMICHAEL, CINDI DENNIS, MARK STILES, ALEXANDER SHAPRIO, BRIAN MARANVILLE, CEDRIC POWELL, NIST — We have investigated a wide variety of soft magnetic layers as sense layers for magnetic-field sensors. We find that in thin-film form, some of these soft materials can have susceptibilities approaching those of the corresponding bulk material. In general, the highest susceptibilities occur in tri-layer structures with a non-magnetic film separating two soft magnetic films. The alloy $Ni_{77}Fe_{14}Cu_5Mo_4$ of the mu-metal family is the softest thin-film material we have found, and we can achieve hard-axis susceptibilities of $\sim 10^5$ in tri-layer structures. The hard axis is preferred for magnetic sensors due to its near-linear response. The major impediment we have found to using these very soft layers in low-field sensors is that the susceptibility decreases by almost two orders of magnitude when the soft structure is incorporated in a standard spin valve or magnetic tunnel junction. In this talk, we will illustrate the problem, show how the structural modifications can minimize the problem, discuss the outlook for the complete elimination of the problem, and assess the prospects for significant improvements in thin-film, low-field magnetic sensors.

William Egelhoff
NIST

Date submitted: 21 Nov 2005 Electronic form version 1.4