Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Magnetic property enhancement of modified nanocrystalline $ZrCo_5$-based magnets[1] WENYONG ZHANG, XINGZHONG LI, RALPH SKOMSKI, JEFF SHIELD, DAVID J SELLMYER, Nebraska Center for Materials and Nanoscience, University of Nebraska, Lincoln, NE68588, NANOMAGNETICS AND MAGNETOELECTRONIC MATERIALS TEAM — The metastable $ZrCo_5$ compound may be a good candidate for the development of rare-earth-free high-performance hard magnetic materials because of its high magnetocrystalline anisotropy field. Melt spinning is a good approach to synthesize metastable phase because of its high quench rate. In this work, the effect of Zr and Fe addition on structure and magnetic properties of melt-spun nanocrystalline $Zr_{1+x}Co_5$(0–0.3) alloys has been investigated. All the samples consist of orthorhombic $ZrCo_5$ hard magnetic and Co/Zr_6Co_{23} soft magnetic phases. Proper Zr addition causes nanostructure refinement and the increase of the hard magnetic phase content, which strengthens intergrain exchange coupling. As a result, coercivity and maximum energy product of $ZrCo_5$-based magnet are significantly enhanced. The best magnetic properties: ${}_iH_c = 2.8$ kOe, $(BH)_{max} = 4$MGOe, which is the best value among Co-Zr binary alloys, are achieved in $Zr_{1.1}Co_5$. The temperature coefficient of its coercivity between 10 and 380K is -0.05%/K. The saturation magnetization of nanocrystalline $Zr_{1.1}Co_5$ is greatly increased due to 16 at% Fe addition.

[1]Research supported by BREM/DOE/Ames Lab and ARO.

Wenyong Zhang
Nebraska Center for Materials and Nanoscience,
University of Nebraska, Lincoln, NE68588

Date submitted: 29 Nov 2011 Electronic form version 1.4