Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Structural stability of $HfCo_7$ and Zr_2Co_{11} magnetic nanoclusters[1]

BALAMURUGAN BALASUBRAMANIAN, BHASKAR DAS, RALPH SKOMSKI, DAVID SELLMYER, Department of Physics and Astronomy and Nebraska Center for Materials and Nanoscience, University of Nebraska — The gas-aggregation-type cluster deposition has emerged as an attractive method to create uniaxially aligned nanoparticle building-blocks of metastable and new permanent-magnet materials such as $HfCo_7$ and Zr_2Co_{11} with appreciable coercivities ($H_c \approx 5.0$ kOe), magnetocrystalline anisotropies ($K_1 \approx 10$ Mergs/cm^3), and magnetic polarization ($J_s \approx 10$ kG) at 300 K. In comparison, bulk $HfCo_7$ and Zr_2Co_{11} alloys form only at ideal stoichiometries and high temperatures above 1000 °C at thermal equiliburium conditions. We have investigated the structural stability of $HfCo_7$ and Zr_2Co_{11} phases on varying their stoichiometries from ideal values in $HfCo_{7\pm\delta}$ and $Zr_2Co_{11\pm\delta}$ nanoclusters ($0 \leq \delta \leq 1$), respectively and compared these results with the corresponding bulk phase diagrams. This study provides new insights to understand the underlying crystal structure and magnetic properties of the nanoclusters and to explore them for significant applications.

[1]This work is supported by the ARPA-E (DE-AR 0000046, B.B), DOE-BREM (DE-AC02-07CH11358, B.D), DOE (DE-FG02-04ER46152, D.J.S.), NSF-MRSEC (DMR-0820521, R.S), and NCMN.

David Sellmyer
Department of Physics and Astronomy and Nebraska Center
for Materials and Nanoscience, University of Nebraska

Date submitted: 16 Nov 2012

Electronic form version 1.4