Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Anomalous thermal hysteresis in the high-field magnetic moments of magnetic nanoparticles embedded in multi-walled carbon nanotubes GUO-MENG ZHAO, California State University, Los Angeles, JUN WANG, Ningbo University, YANG REN, Argonne National Lab, PIEDER BEELI, California State University, Los Angeles — We report high-temperature (300-1120 K) magnetic properties of Fe and Fe_3O_4 nanoparticles embedded in multi-walled carbon nanotubes. We unambiguously show that the magnetic moments of Fe and Fe_3O_4 nanoparticles are seemingly enhanced by a factor of about 3 compared with what they would be expected to have for free (unembedded) magnetic nanoparticles. What is more intriguing is that the enhanced moments were completely lost when the sample was heated up to 1120 K and the lost moments at 1120 K were completely recovered through several thermal cycles below 1020 K. The anomalous thermal hysteresis of the high-field magnetic moments is unlikely to be explained by existing physical models except for the high-field paramagnetic Meissner effect due to the existence of ultrahigh temperature superconductivity in the multi-walled carbon nanotubes.

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Date submitted: 11 Nov 2011 Electronic form version 1.4