Supporting Information

Survival of Verwey Transition in Gadolinium-Doped Ultrasmall Magnetite Nanoparticles

Sunmog Yeo,[a] Hyunkyung Choi,[b] Chul Sung Kim,[b] Gyeong Tae Lee,[c] Jeong Hyun Seo,[c] Hyung Joon Cha,[d] and Jeong Chan Park*[d]

[a]Korea Multi-purpose Accelerator Complex, Korea Atomic Energy Research Institute, Gyeongju, 305-353, Korea.

[b]Department of Physics, Kookmin University, Seoul 136-702, Korea

[c]School of Chemical Engineering, Yeungnam University, Gyeongsan 38541, Korea

[d]Department of Chemical Engineering, Pohang University of Science and Technology, Pohang 790-784, Korea.
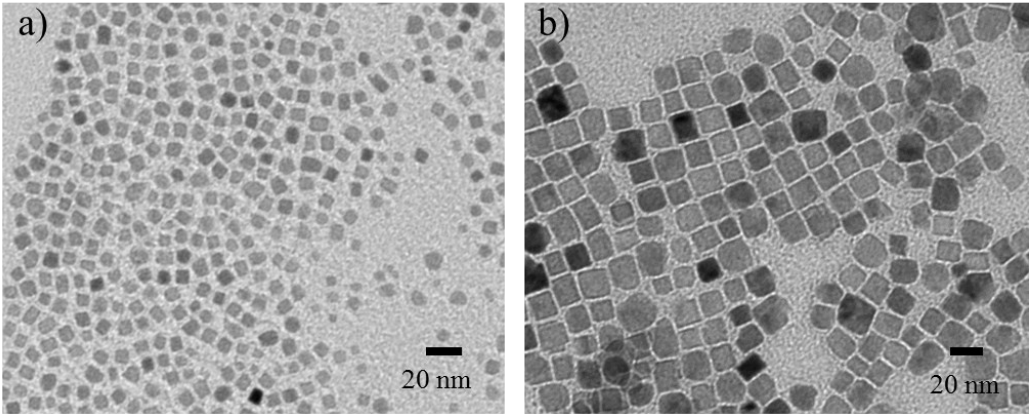
E-mail: goodnews@postech.ac.kr

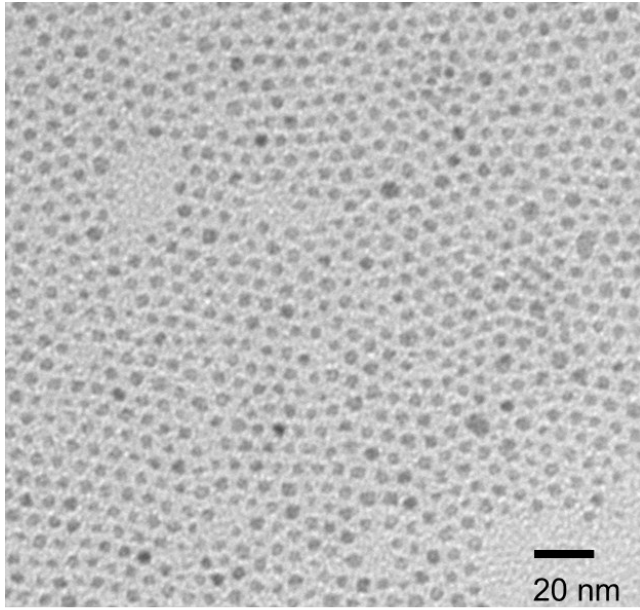Fig. S1. TEM images of a) GdIO-3 and b) GdIO-4

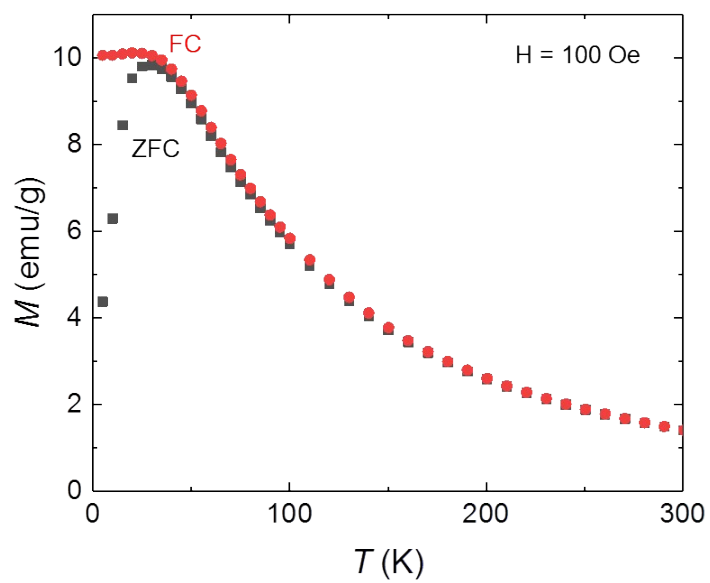Fig. S2. TEM analysis of irregular shaped IO (ir-IO)

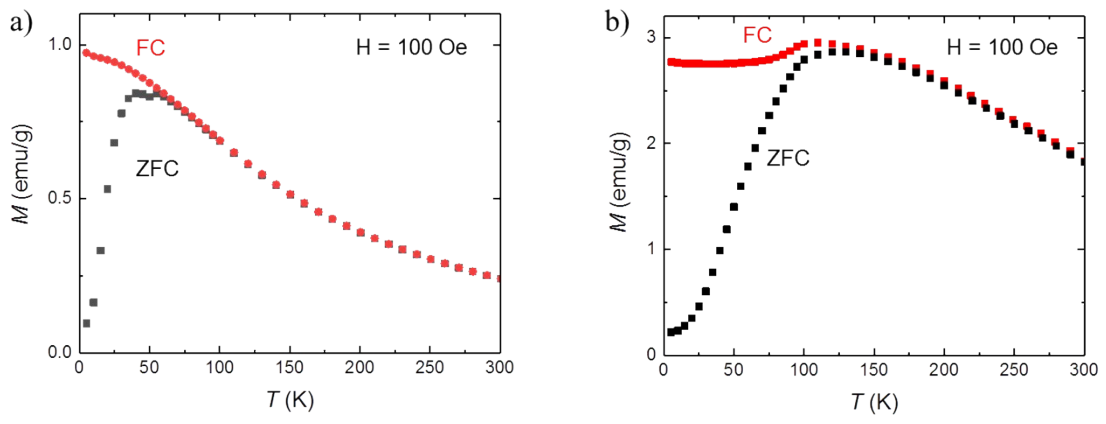Fig. S3. ZFC and FC curves of irregularly shaped IO (ir-IO)

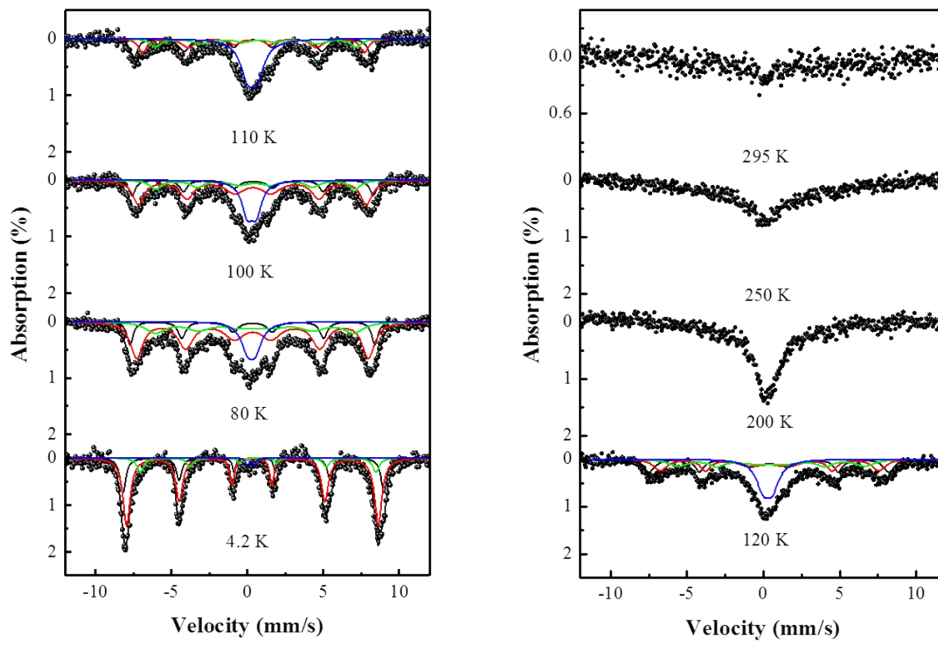Fig. S4. ZFC and FC curves of a) GdIO-3 and b) GdIO-4 at H=100 Oe
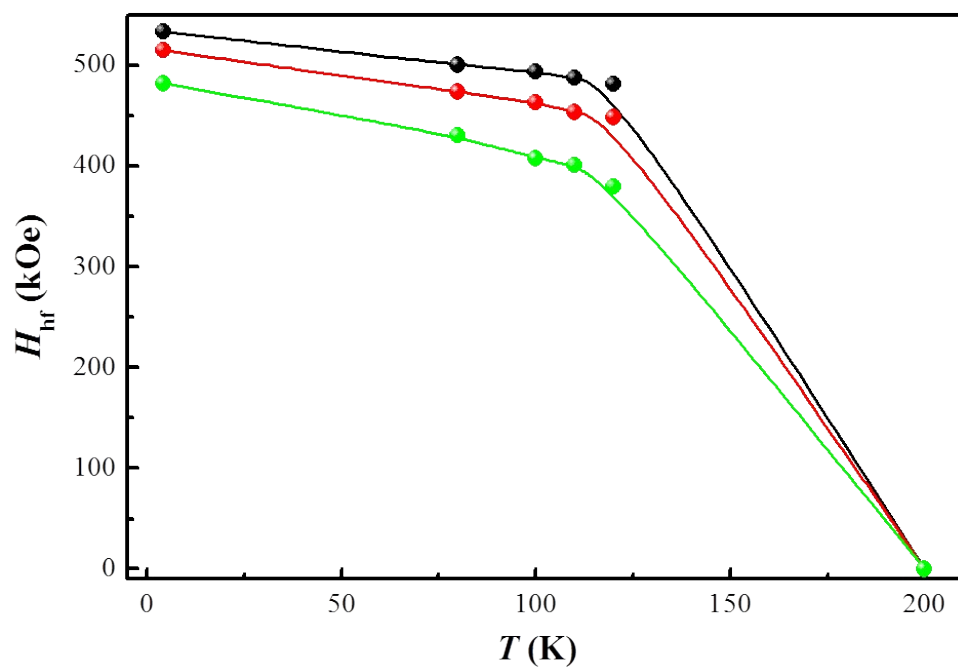
Fig. S5. The Mössbauer spectra of GdIO-2

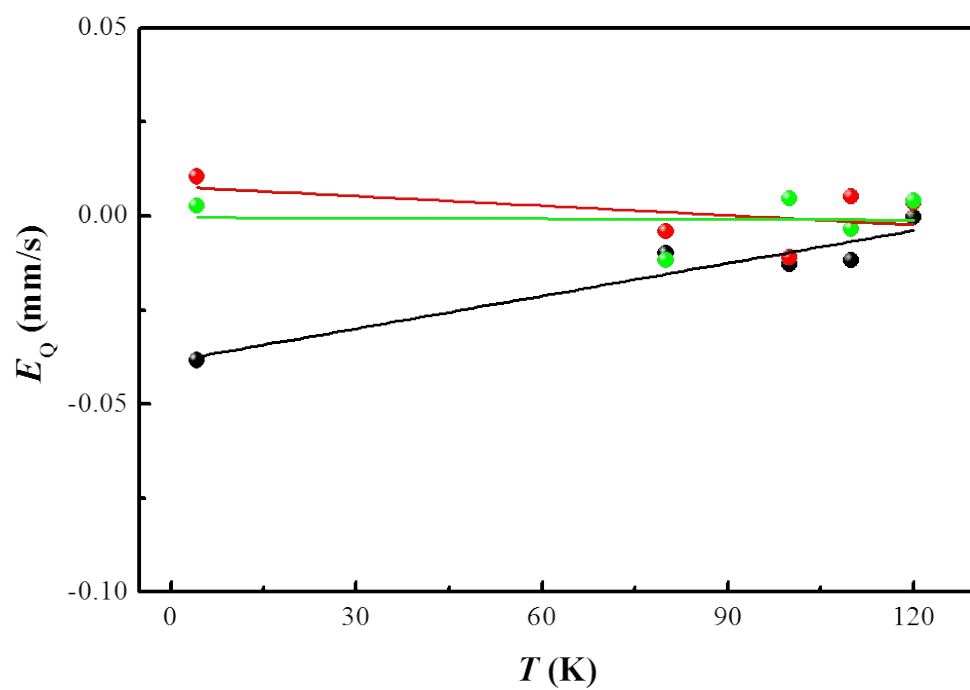Fig. S6. The temperature dependence of magnetic hyperfine field (H_{hf}) of GdIO-2

Fig. S7. The temperature dependence of the electric quadrupole splitting (ΔE_Q) of GdIO-2

Table S1. Mössbauer parameters of GdIO-2 at various temperatures.

T (K)	$H_{\text{hf,A}}$ (kOe)	$H_{\text{hf,B1}}$ (kOe)	$H_{\text{hf,B2}}$ (kOe)	$\Delta E_{\text{Q,A}}$ (mm/s)	$\Delta E_{\text{Q,B1}}$ (mm/s)	$\Delta E_{\text{Q,B2}}$ (mm/s)	δ_{A} (mm/s)	δ_{B1} (mm/s)	δ_{B2} (mm/s)
4.2	534	515	482	-0.04	0.01	0.00	0.44	0.32	0.70
80	501	474	430	-0.01	-0.00	-0.01	0.37	0.34	0.55
100	494	463	408	-0.01	-0.01	0.00	0.37	0.34	0.51
110	487	454	401	-0.01	0.01	0.00	0.36	0.36	0.50
120	481	448	380	0.00	0.00	0.00	0.36	0.38	0.50