
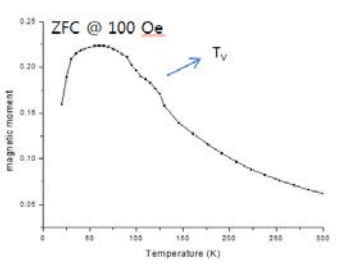
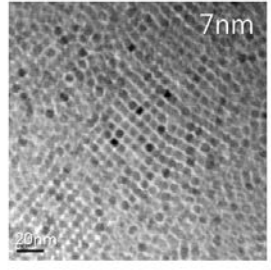
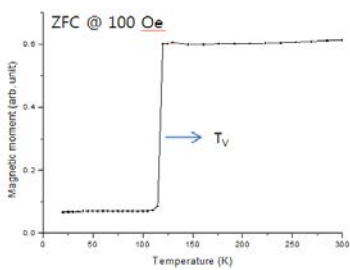
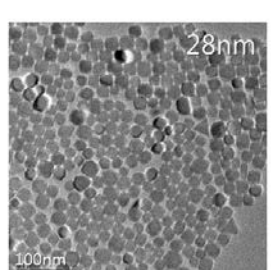


(※本報告書は英語で記述してください。ただし、産業利用課題として採択されている方は日本語で記述していただいても結構です。)

 MLF Experimental Report	提出日 Date of Report 2013.06.21
課題番号 Project No. 2012B0189 実験課題名 Title of experiment Temperature dependence of spin waves in Fe ₃ O ₄ magnetite nano particle 実験責任者名 Name of principal investigator Je-Geun Park 所属 Affiliation Seoul National University, Korea	装置責任者 Name of responsible person 装置名 Name of Instrument/(BL No.) BL-14 Cold-Neutron Disk-Chopper Spectrometer (AMATERAS) 実施日 Date of Experiment 2012.12.05-2012.12.08

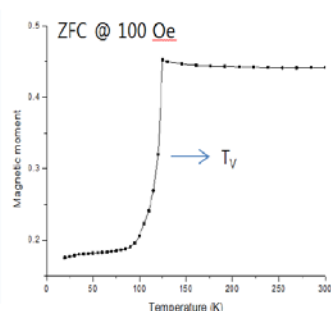
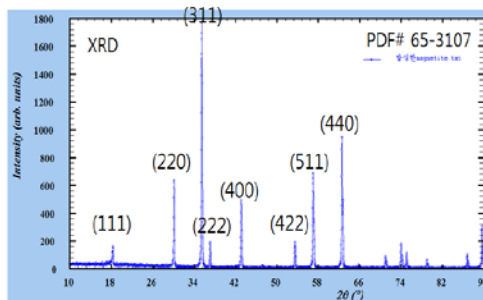
試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。(適宜、図表添付のこと)
 Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

1. 試料 Name of sample(s) and chemical formula, or compositions including physical form.
Fe ₃ O ₄ nanoparticle powder and Fe ₃ O ₄ bulk powder

2. 実験方法及び結果 (実験がうまくいかなかった場合、その理由を記述してください。)
<p>Experimental method and results. If you failed to conduct experiment as planned, please describe reasons.</p> <p>By conducting AMATERAS experiment, we tried to see magnon with (nano domain) size effect. Since magnetite has an intrinsic metal-insulator transition which is called a Verwey transition, we also tried to see changes in the magnon above and below the transition temperature. For that, we synthesized several grams of monodisperse nanoparticle with a wet chemical method and also prepared bulk powder as a reference (see the pictures). Moreover, we kept powder samples under Ar gas atmosphere to avoid oxidation and humidify problem of nanoparticle.</p> <div style="display: flex; justify-content: space-around;"> <div>  </div> <div>  </div> <div>  </div> <div>  </div> </div>

2. 実験方法及び結果(つづき) Experimental method and results (continued)

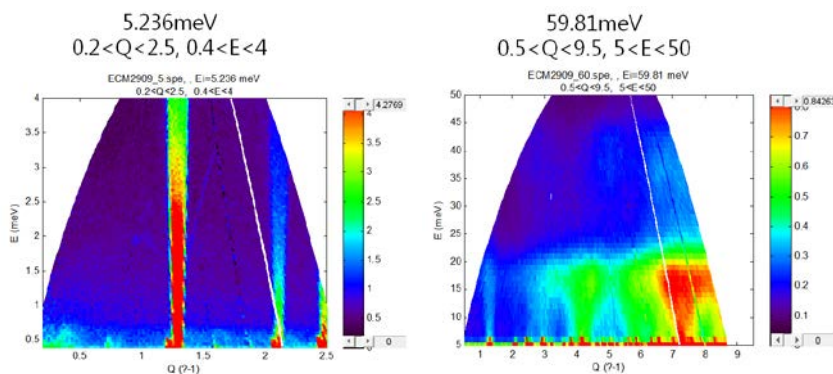
Before conducting AMATERAS experiment, we confirmed by bulk characterization that there is indeed a transition for our nanoparticles. There is a clear magnetic moment anomaly near 120K in the data. Our XRD result also confirmed that the sample is pure magnetite.



We carried out our measurements at the following conditions.

Sample	beam #	Temp.	meV			
28nm	2882	292K	59.81	18.61	8.9361	5.236
	2882	200~292K	59.81	18.61	8.9361	5.236
	2883	5K	59.81	18.61	8.9361	5.236
	2899	5K	3.13435	1.68618	1.05106	
	2902	90K	3.13435	1.68618	1.05106	
	2904	150K	3.13435	1.68618	1.05106	
	2906	300K	3.13435	1.68618	1.05106	
Bulk	2909	300K	59.81	18.61	8.9361	5.236

For the bulk reference sample, we succeeded in observing clear sings of magnon (see the picture below).



However, most of our data were overshadowed by much stronger phonon scattering from surfactant and we failed to observe a clear experimental evidence of magnon in nanoparticles.

