Synthesis and Magnetic Properties of FeRh Nanoparticles and FePt/FeRh Composites

Zhiyong Jia, S. Kang, N. Seetela, M. Shamsuzzoha, David E. Nikles, and J. W. Harrell

MINT Center, The University of Alabama, Tuscaloosa, Alabama 35487-0209

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Motivation

• Smaller grain size which is approaching SPM limit.
• FePt has high $K_u$ but also very high coercivity which makes it hard to write.
• FeRh has a AF-F transition between 50 and 100°C and $T_{AF-F}$ can be increased by alloying with Ir and Pt.

Synthesis of 6 nm FeRh

Rh(acac)$_2$ (0.25 mmol) + FeCl$_2$·4H$_2$O (0.3 mmol)
↓
Heat to 100 °C in 30 min.
Inject in Oleic acid (0.16 mL) + Oleylamine (0.17 mL)
↓
Heat to 200 °C @ 10°C/min
↓
Inject in 1.5 mL Superhydrate
↓
Increase to 260°C and reflux for 1 hour
↓
Cool down to 50 °C
↓
Participate particles
Isolate Particles by Centrifuging

XRD patterns and Hysteresis of as-prepared 6 nm FeRh

Conclusions

• Synthesis of FeRh Nanoparticles of about 6 nm.
• Temperature-dependent M curve of FePt/FeRh nanocomposites annealed at 500°C and 600°C shows AF-F transition
• FePt/FeRh nanocomposites annealed at 700°C does not show AF-F transition

For more information contact:
Zhiyong Jia
MINT Center. U. Alabama
E-mail: zjia@mint.ua.edu

As prepared FeRh are mixed with previously prepared FePt at a volume ratio of 4:1.
The mixed FePt/FeRh are then annealed at 500, 600 and 700°C for 30 minutes.
XRD and magnetic measurement are made after the annealing.

TEM image of FePt/FeRh mixture w/o annealing

HRTEM of annealed FeRh/FePt composite

Hysteresis loop of FePt/FeRh annealed at 500°C

M vs Temp. of FePt/FeRh annealed at 500°C and 700°C


Hysteresis loop of FePt/FeRh annealed at 500°C and 700°C