Nucleation and Growth of FePt Nanoparticles under High Magnetic Field

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Objectives

Operating nucleation and growth are the keys to control the crystal preparation, which is beneficial to obtain materials with controllable structure and performance. Recently, the development of superconductive technology inspires us to apply the high magnetic field (HMF) into the materials formation process, to operate the nucleation and growth process of crystals by a non-contact and environmental friendly style. The HMF presents significance effects on the nucleation and growth of 3D-bulk or 2D-film materials. Will it affects the growth of low-dimensional nanomaterials?
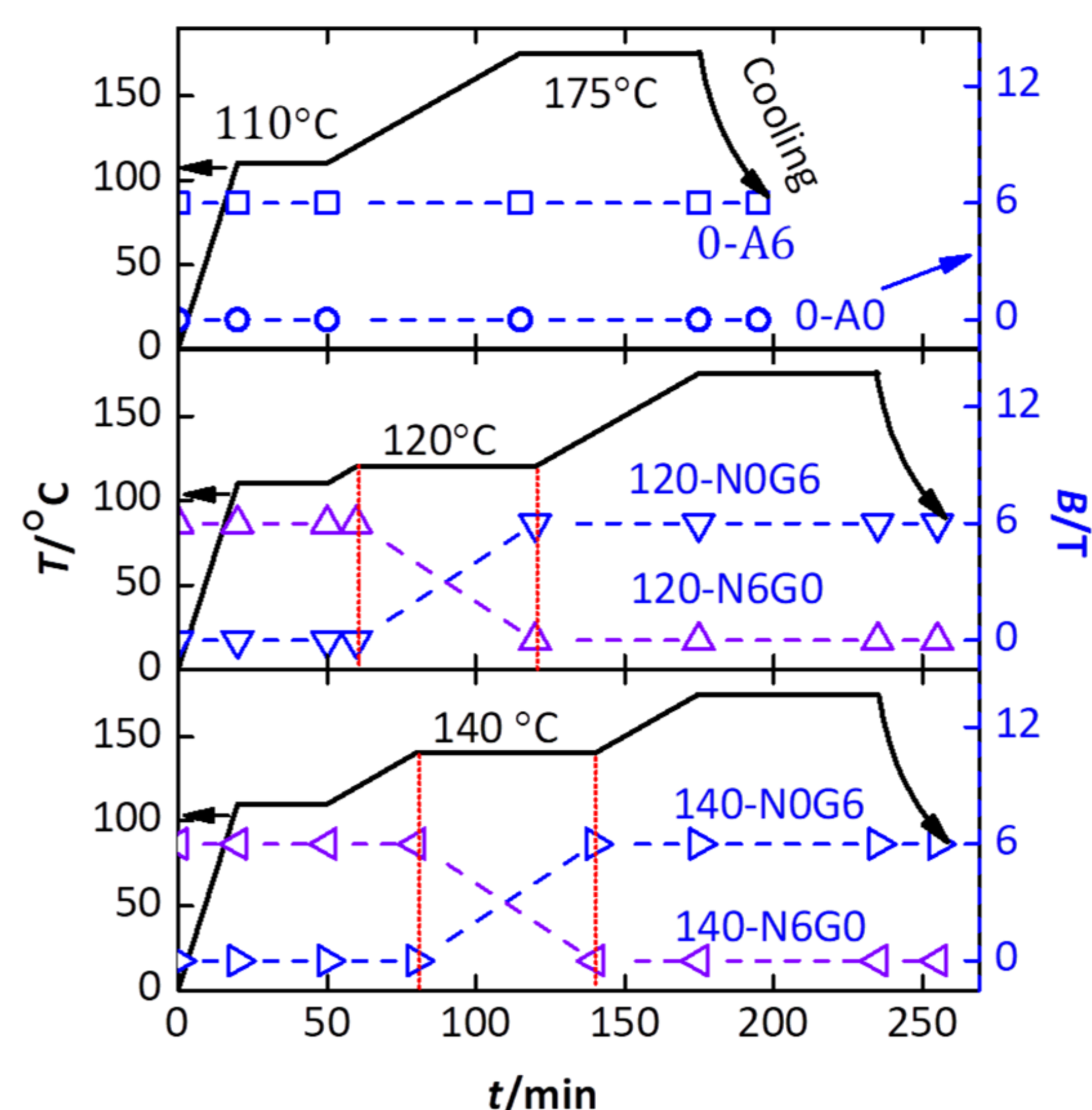
Experimental

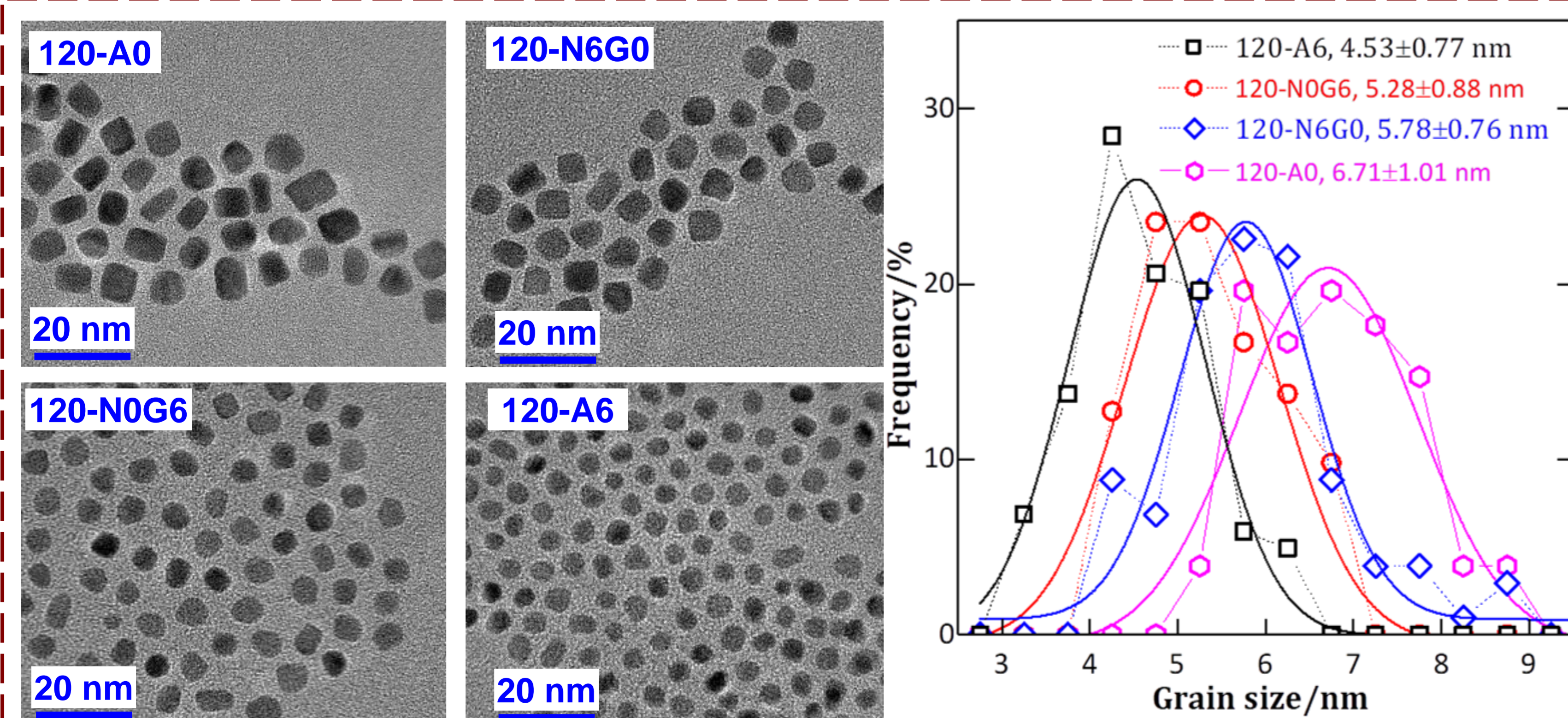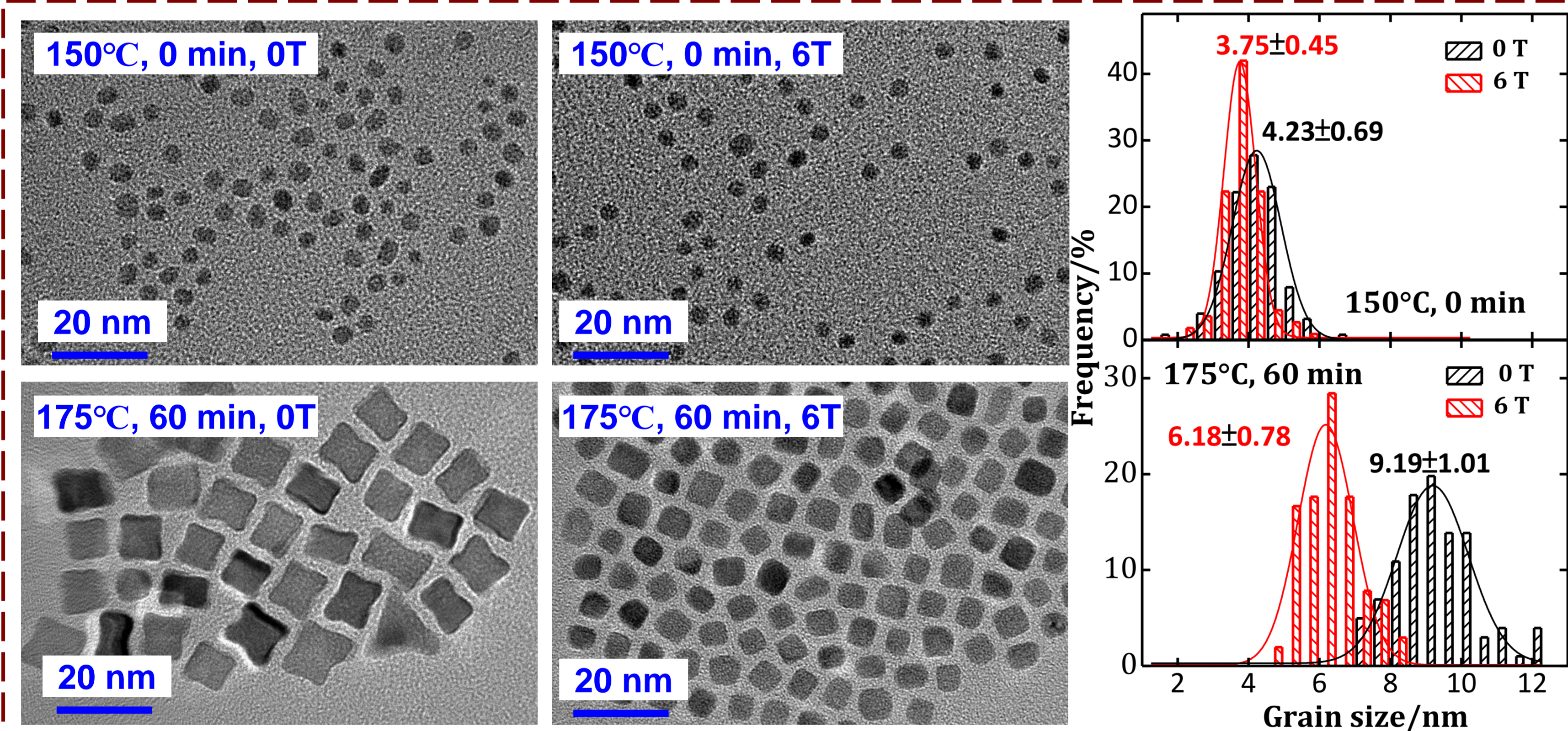| Chemical Agent		
Function	Name	Formula
Precursor	Platinum acetylacetonate	$Pt(acac)_2$: $C_{10}H_{14}O_4Pt$
	Iron pentacarbonyl	$Fe(CO)_5$
Solvent	Dibenzyl ether	$C_{14}H_{14}O$
Reduction	1,2-Hexadecanediol (HDD)	$C_{16}H_{34}O_2$
Surfactant	Oleylamine (OAm)	$C_{18}H_{37}N$
	Oleic acid (OA)	$C_{18}H_{34}O_2$
	Octadecene (ODE)	$C_{18}H_{36}$
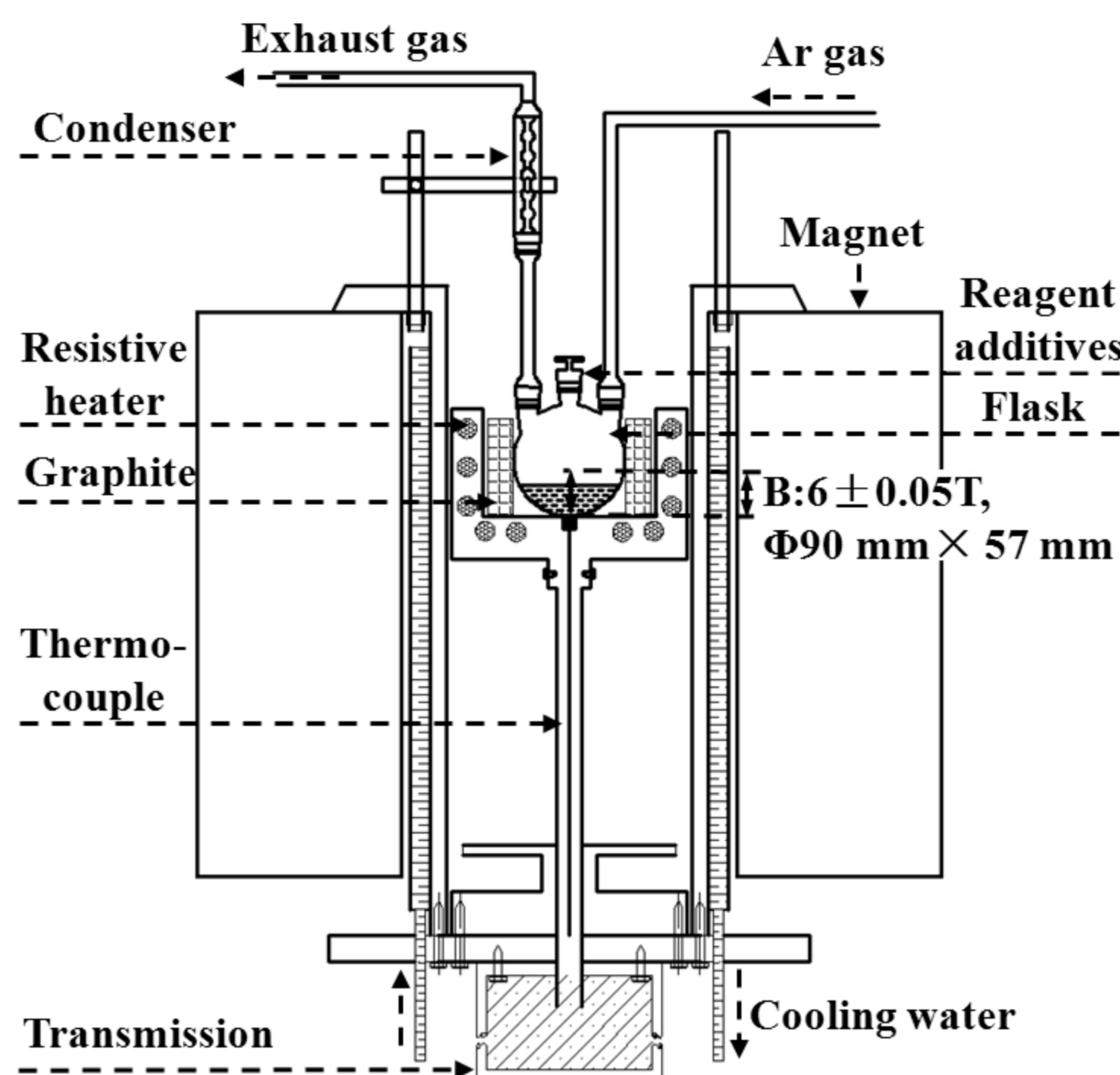
Experimental apparatus

Temperature & Magnetic field curve
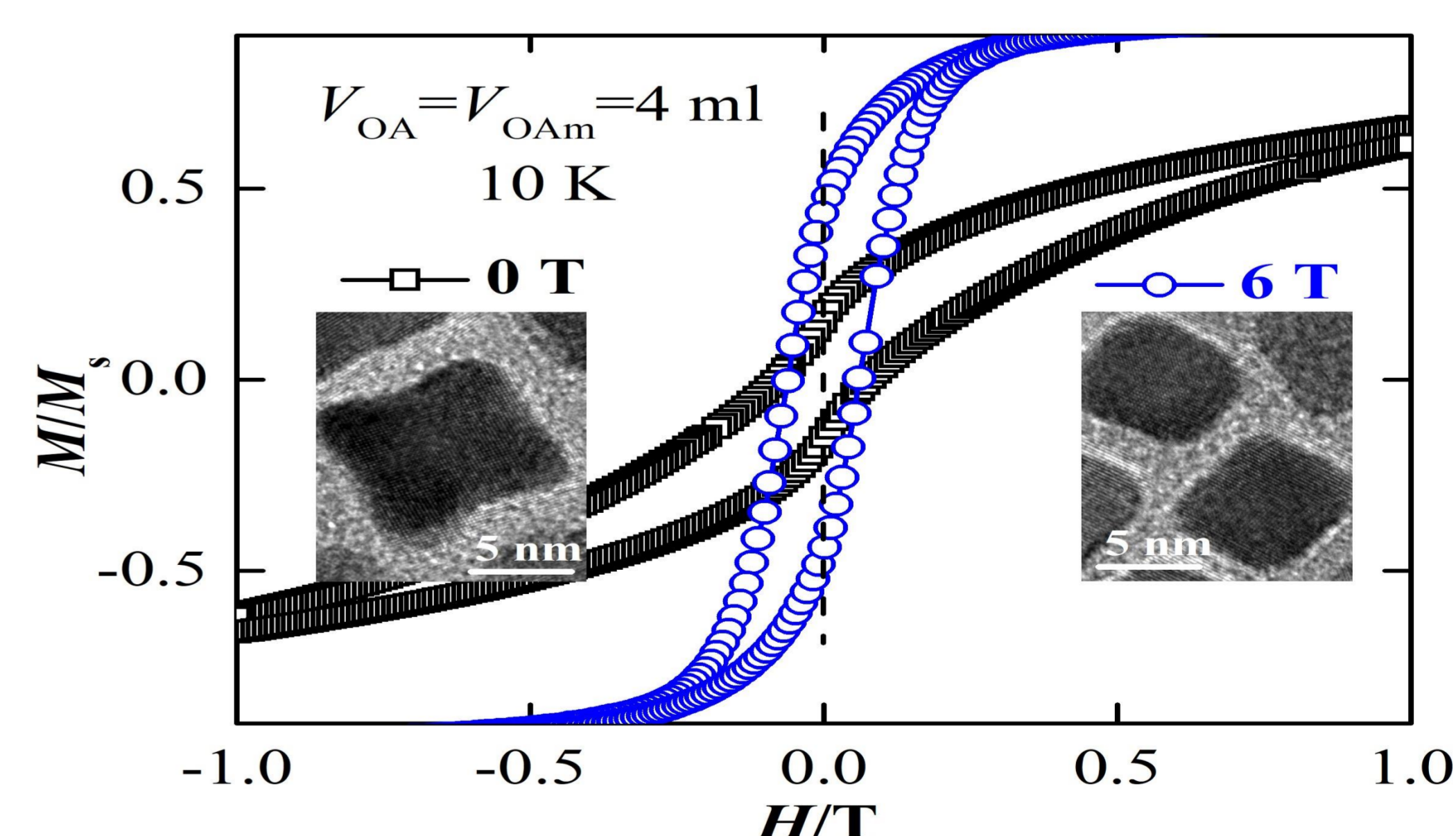
Results:

Conclusions:

◆ **Effects of HMF on nucleation and growth:**

a. Nucleation — Nucleation rate dN/dt : +50%

0 T   6 T

Nucleus

b. Growth

Size d -20% -10% d d -30%
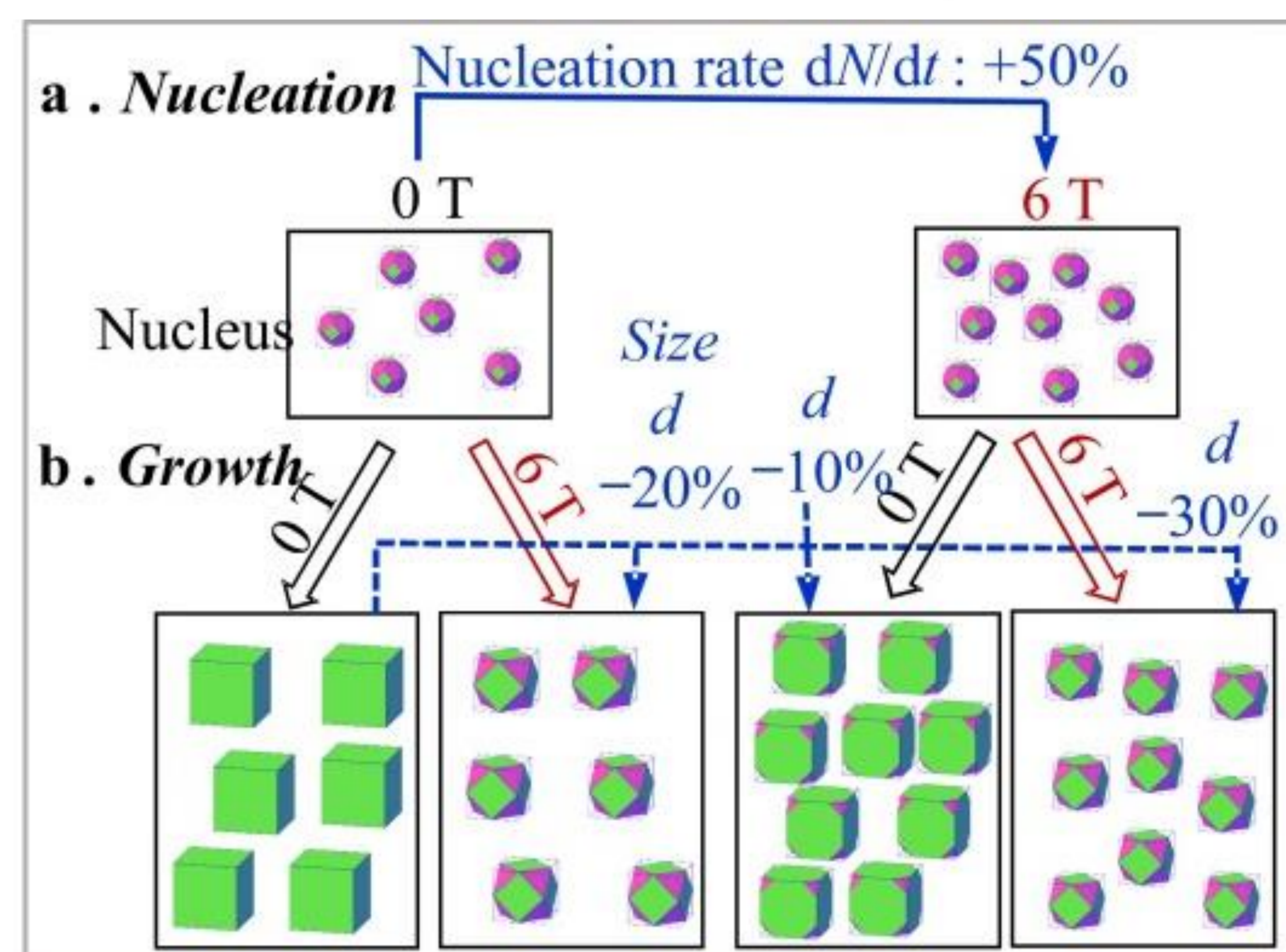
◆ **Tuning magnetic properties by HMF:**

$V_{OA} = V_{OAm} = 4$ ml
10 K

Publication:

◆ Chun Wu, Xiaoyang Wang, Wenli Pei*, et al. Nanoscale, 2019, 11: 15023-15028;
◆ Xiao Duan#, Chun Wu#, Xiaoyang Wang, et al. Journal of Alloys and Compounds, 2019, 797: 1372-1377;
◆ Chun Wu, Wenli Pei*, Fei Huang, et al. Journal of Nanoscience and Nanotechnology, 2017, 17: 7003-7007;
◆ Chun Wu, Wenli Pei*, Xiaoyang Wang, et al. RSC Advances, 2016, 6: 84684-84688.

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