Supplement information

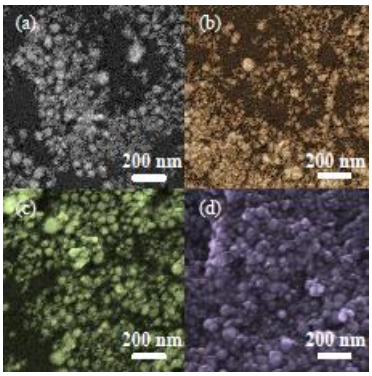

Figure S1 (a-d) SEM images of the samples S1, S2, S3 and S4, respectively.

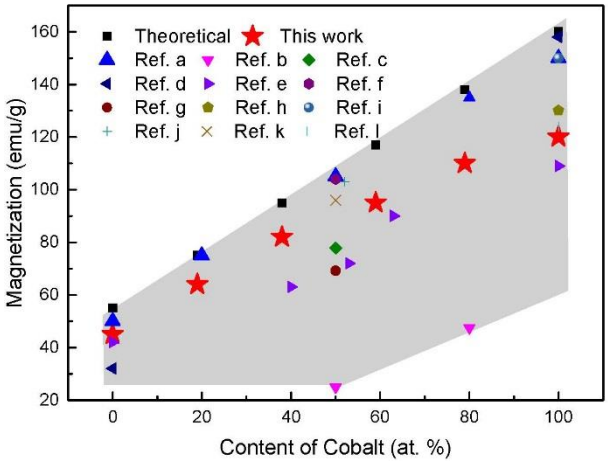

Figure S2 The theoretical and experimental magnetization of Co, Ni and their alloys in this manuscript and in literatures.

Table SI Co content of Co_xNi_{100-x} nanocapsules (samples S1, S2, S3 and S4); Saturation magnetization (*M*s), Loss of *M*s comparing with theoretical value, content of carbon in nanocapsules, DSC peak positions.

Sample	Nanocapsules (at. % Co)	M_s (emu/g)	Loss of M_s (percent)	Content of Carbon (wt. %)	First peak of DSC (℃)	Second peak of DSC (℃)
S1	23	64	14.6%	7.8%	261	372
S2	42	82	13.6%	8.9%	282	387
S3	56	95	18.7%	9.3%	295	390
S4	77	110	20.2%	8.6%	282	383

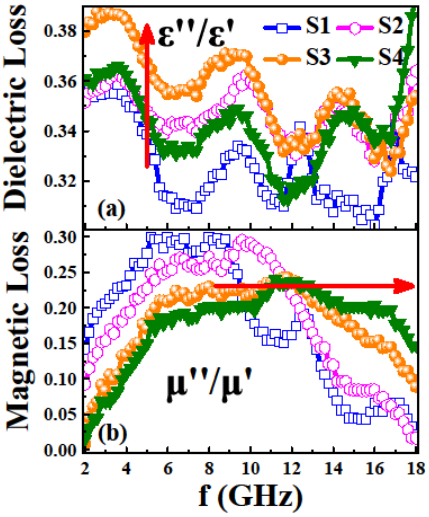

Figure S3 Frequency dependence of (a) the dielectric loss and (b) the magnetic loss factors of the samples S1, S2, S3 and S4.

1. Calculation of amount of gas and the H/O ratio

The chamber volume is 0.2 m^3

The amount of Ar

P=0.0183 Mpa, V=0.2 m^3, R=8.314 J/(mol K), T=300 K

PV=nRT

$1.83\times10^4\times0.2=n\times8.314\times300 \rightarrow n=1.467$ mol

The amount of H_2

P=0.0037 Mpa, V=0.2 m^3, R=8.314 J/(mol K), T=300 K

PV=nRT

$3.7\times10^3\times0.2=n\times8.314\times300 \rightarrow n=0.297$ mol

The amount of C_2H_6O

V=30 ml(volume), M= 46 g/mol (Mole mass), ρ= 0.789 g/cm^3(density)

$n=\rho\times V/M=0.515$ mol

The ratio of H to O

$r=H/O=(0.297\times2+0.515\times6)/0.515=7.15$

2. Calculation of magnetization difference

M_{Co}=160 emu/g; M_{Ni}=55 emu/g

Theoretical magnetization

$M_{S1T}=0.19\times160+0.81\times55=74.95$ emu/g

$M_{S2T}=0.38\times160+0.62\times55=94.9$ emu/g

$M_{S3T}=0.59\times160+0.41\times55=116.95$ emu/g

$M_{S4T}=0.79\times160+0.21\times55=137.95$ emu/g

The difference of magnetization between theoretical and experimental

M_{S1E} =64 emu/g, M_{S2E} =82 emu/g, M_{S3E} =95 emu/g, M_{S4E} =110 emu/g,

$\Delta M_{S1}=(M_{S1T}- M_{S1E})/ M_{S1T}=14.6\%$

$\Delta M_{S2}=(M_{S2T}- M_{S2E})/ M_{S2T}=13.6\%$

$\Delta M_{S3}=(M_{S3T}- M_{S3E})/ M_{S3T}=18.7\%$

$\Delta M_{S4}=(M_{S4T}- M_{S4E})/ M_{S4T}=20.2\%$

3. **Calculation of carbon mass content**

X/Y=mole ratio of Co and Ni atom in nanocapsules

X*Co+Y*Ni + C=nanocapsules mass before DSC

$X*CoO_{4/3}$+Y*NiO= sample mass after DSC

C_{S1} = 7.8%

C_{S2} = 8.9%

C_{S3} = 9.3%

C_{S4} = 8.6%

Notes and references

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