One-step synthesis of magnetically recyclable Co@BN core-shell nanocatalysts for catalytic reduction of nitroarenes

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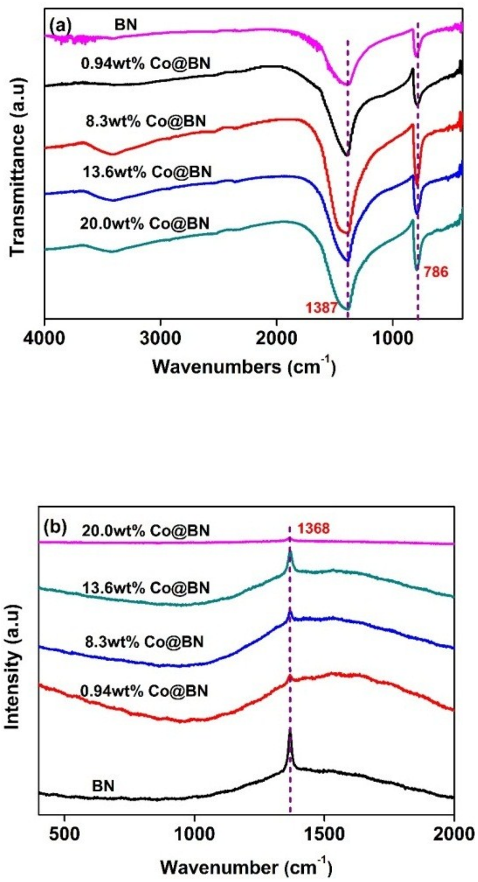
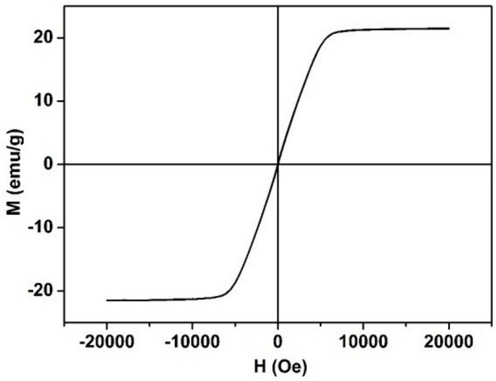


Fig. S1 (a) FTIR and (b) Raman spectra of *h*-BN and the Co@BN samples with various Co contents.

(a)



(b)

Fig. S2. (a) Hysteresis loops of the 13.6 wt% Co@BN nanocatalyst measured at 300 K. (b) photographs of the Co@BN dispersion before (left) and after (right) the magnetic separation.

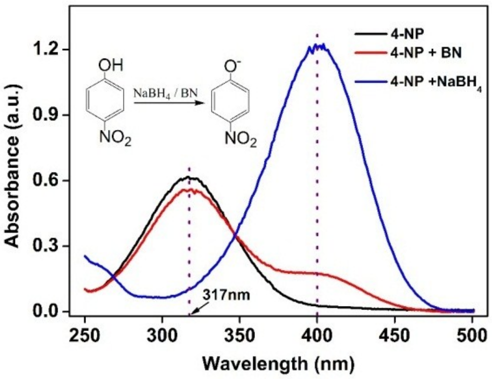


Fig. S3. Evolution of UV-vis spectra of the 4-NP solution added with $NaBH_4$ or *h*-BN.

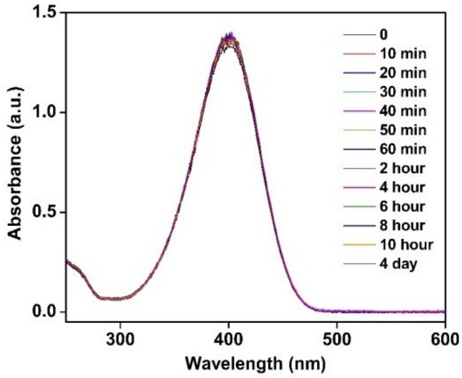
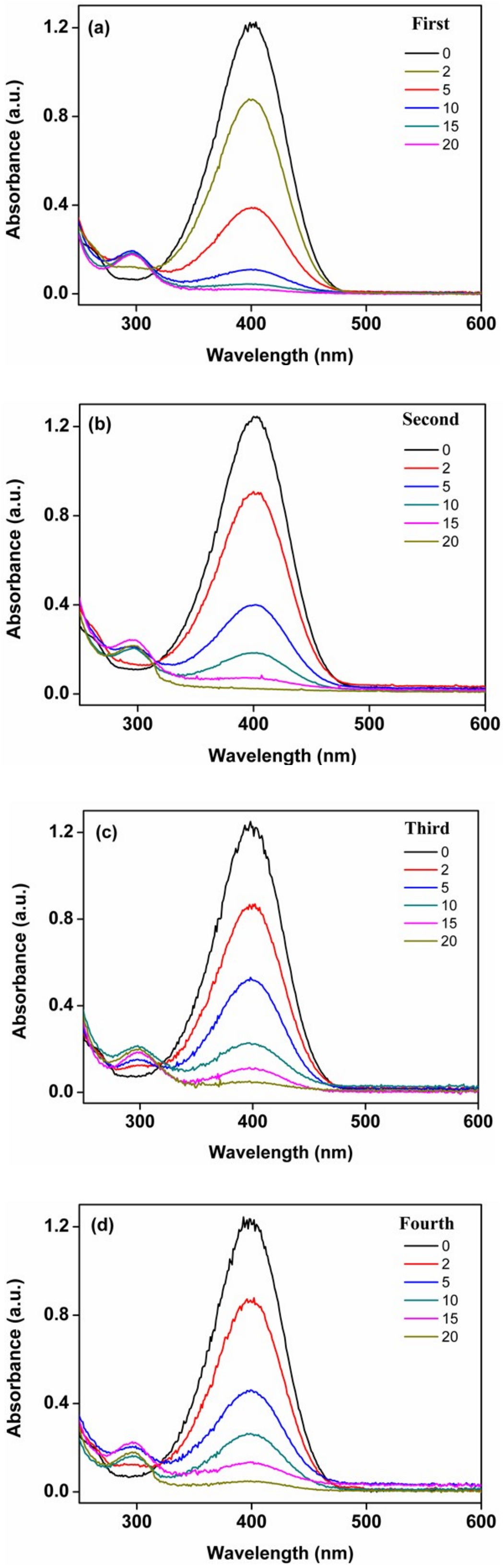


Fig. S4. Catalytic reduction of 4-nitrophenol in the presence of $NaBH_4$.


(a)
First
0
2
5
10
15
20
Absorbance (a.u.)
Wavelength (nm)
(b)
Second
0
2
5
10
15
20
Absorbance (a.u.)
Wavelength (nm)
(c)
Third
0
2
5
10
15
20
Absorbance (a.u.)
Wavelength (nm)
(d)
Fourth
0
2
5
10
15
20
Absorbance (a.u.)
Wavelength (nm)

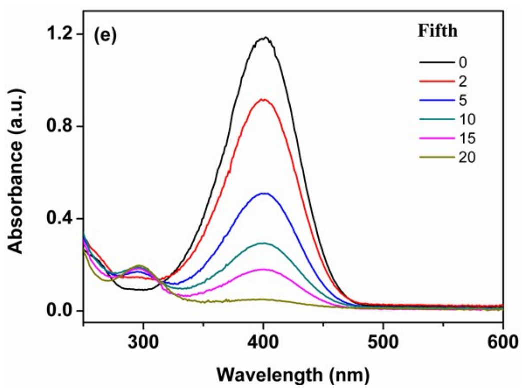


Fig. S5. Successive UV-vis spectra for the reduction reaction of 4-NP by $NaBH_4$ using the catalyst of 13.6 wt% Co@BN nanoparticles in each catalysis recycle.

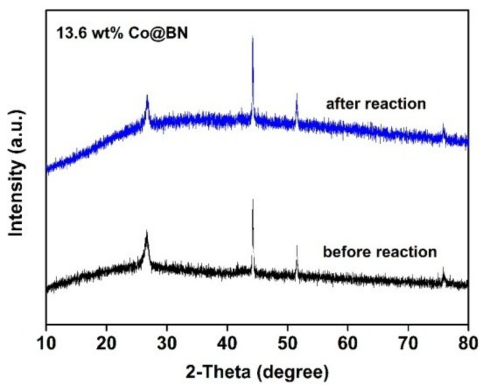
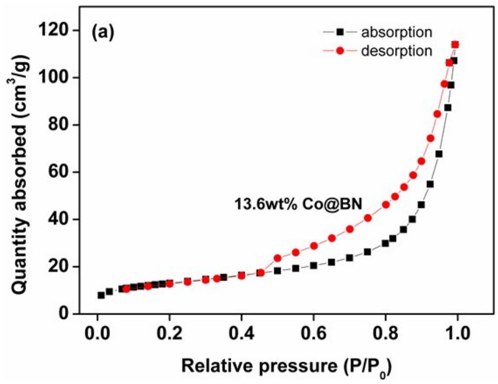


Fig. S6. XRD patterns of 13.6 wt% Co@BN nanoparticles before and after the reaction.



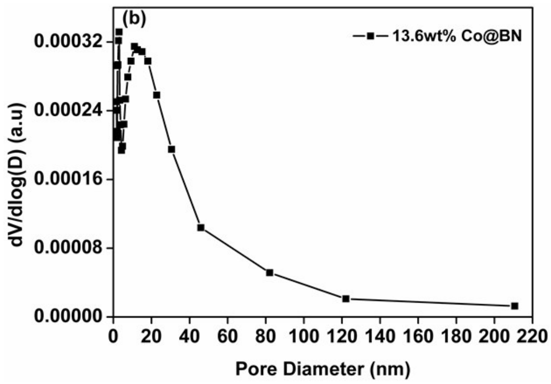


Fig. S7. (a) N_2 adsorption–desorption isotherms and (b) the corresponding pore size distributions of 13.6 wt% Co@BN.

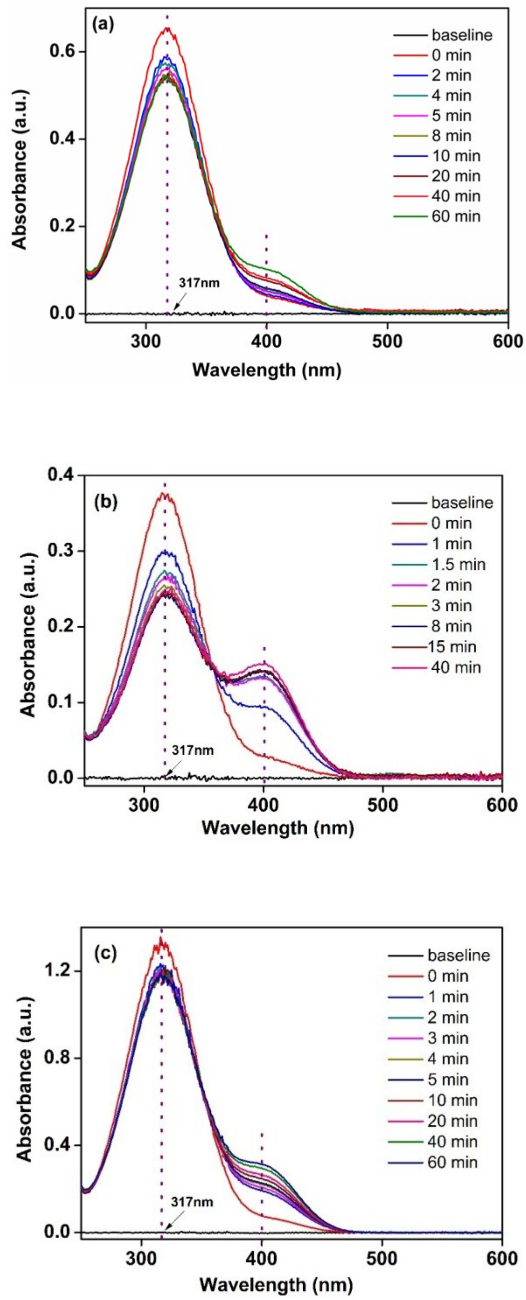


Fig. S8. Absorbance of 4-NP at a concentration of (a) 100 ppm，(b) 50ppm and (c) 200ppm in the presence of *h*-BN (10 mg).

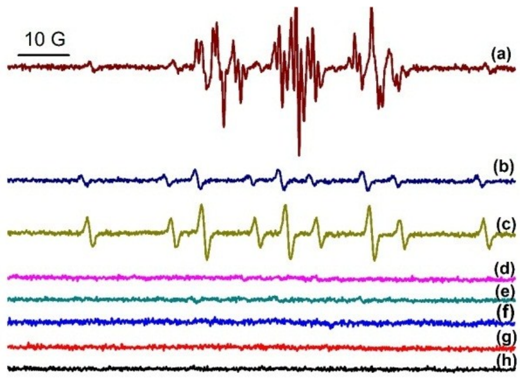


Fig. S9. Spin adducts formed in the presence of (a) 4-NP+$NaBH_4$+catalyst+DMPO, (b) 4-NP+$NaBH_4$+DMPO, (c) $NaBH_4$+DMPO, (d) catalyst + DMPO, (e) 4-NP+ DMPO, (f) catalyst, (g) $NaBH_4$ and (h) 4-NP.

Table S1. Reduction of 4-nitrophenol to 4-aminophenol by some cobalt-based catalysts.

Entry	catalyst	Yield (%)	Con. (%)	TONs	Select. (%)[a]	Ref[c]
1	FeCo@N-doped C	N. P.[b]	>95	10	N. P.	1
2	Co@N-C 700	N. P.	>99	6	N. P.	2
3	p(AMPS)–Co	N. P.	>97	5	N. P.	3
4	Co@BN	>96	>96	5	>99	This work
5	Co@SiO_2	N. P.	>99	4	N. P.	4
6	meso-Co-150	N. P.	>99	4	N. P.	5
7	Co-NC	N. P.	>93	4	N. P.	6

[a] The selectivity can reach >99% because 4-aminitrophenol is the sole product for this model reaction.

[b] N. P.: Not provided.

[c] Refs:

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Table S2. The load of Co on the recycled catalyst 13.6 wt% Co@BN.

Recycle	Initial	First run	Second run	Third run	Fourth run	Fifth run
Co wt%	13.6	13.3	13.2	12.9	12.5	11.5