Supporting Information

Experimental

Reagents and materials

Ethylenediaminetetraacetic acid disodium cobalt salt hydrate ($Na_2CoEDTA$), Hexachloroplatinic acid hexahydrate ($H_2PtCl_6 \cdot 6H_2O$, 99.9 %), Ammonia borane (NH_3BH_3, 98 %), sodium hydroxide (NaOH) were purchased from Aladdin. Deuterium oxide (D_2O) was obtained from Innochem. All other reagents were commercially available and used without further purification.

Characterizations

The morphology and structure of the samples were characterized using transmission electron microscopy (TEM) on a JEOL JEM-2100 FFEGTEM. The morphology and distribution of element of the catalysts were tested by scanning electron microscopy (SEM, Sigma 500 field emission scanning electron microscope). Powder X-ray diffraction (XRD) was performed on Rigaku D/Max-2400X with Cu Ka radiation. X-ray photoelectron spectroscopy (XPS) spectra were obtained from an ESCALABMKLL X-ray photoelectron spectrometer using an Al Kα source. The thermo gravimetric analysis (TGA) was measured using Diamond TG/DTA instruments (STA 449C Jupiter, Netzsch) under a nitrogen atmosphere up to 800 °C with a heating rate of 5.0 °C min^{-1}. Surface Areas were determined by BET measurements using an Autosorb-1 Surface Area Analyzers (Quanta chrome Instrument Corporation).

Calculation

The TOF value was determined based on the reported literature using the eq.(S1)

$$TOF = \frac{P_{atm}/RT}{n_{Pt}t} \quad \text{(S1)}$$

where P_{atm} is the atmospheric pressure (101325 Pa), V_{H_2} is the volume of generated hydrogen when conversion rate of 50 %, Rrepresents the ideal gas constant (8.314 J $mol^{-1} \cdot K^{-1}$), T is the reaction temperature (K), n_{Pt} is the total mole number of Pt atoms in catalyst, and t is the reaction time.

The catalysts nearly show zero-order reaction kinetics with respect to ammonia borane in the reaction period. Therefore, the reaction rate law could be described as:

$r = k$ (S2)

where k is the reaction constant.

The KIE was determined on the basis of the reported literature using the eq.(S3)

$KIE = k_H / k_D$ (S3)

where k_H is the reaction constant of the reaction in H_2O, k_D is the reaction constant of the reaction in D_2O.

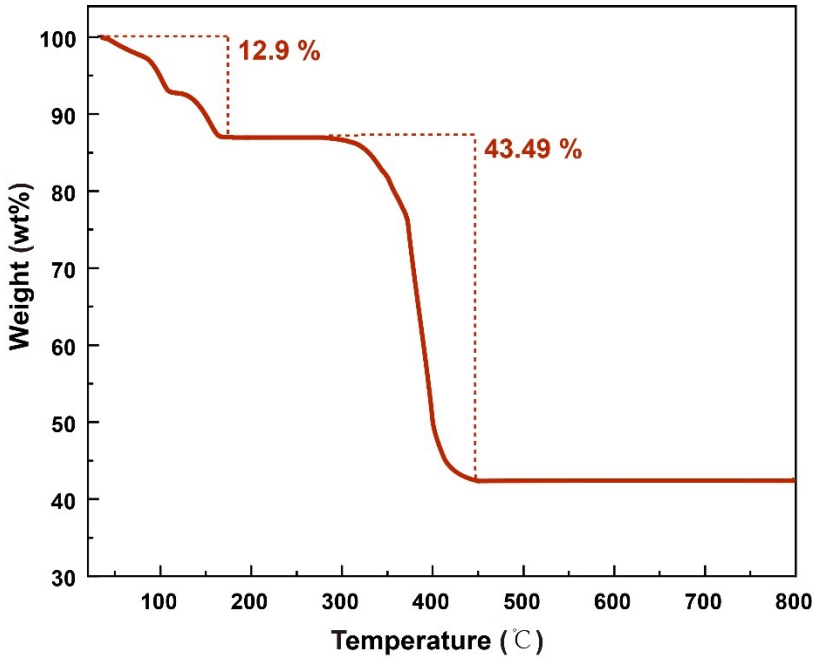

Fig. S1. TGA analysis in air atmosphere for $Na_2CoEDTA$.

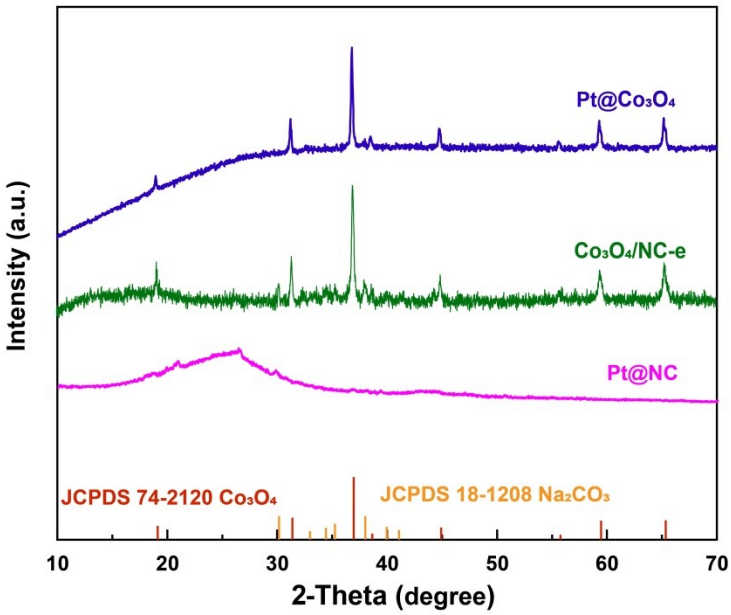

Fig. S2. XRD patterns of Pt@Co_3O_4, Co_3O_4/NC-e, and Pt@NC.

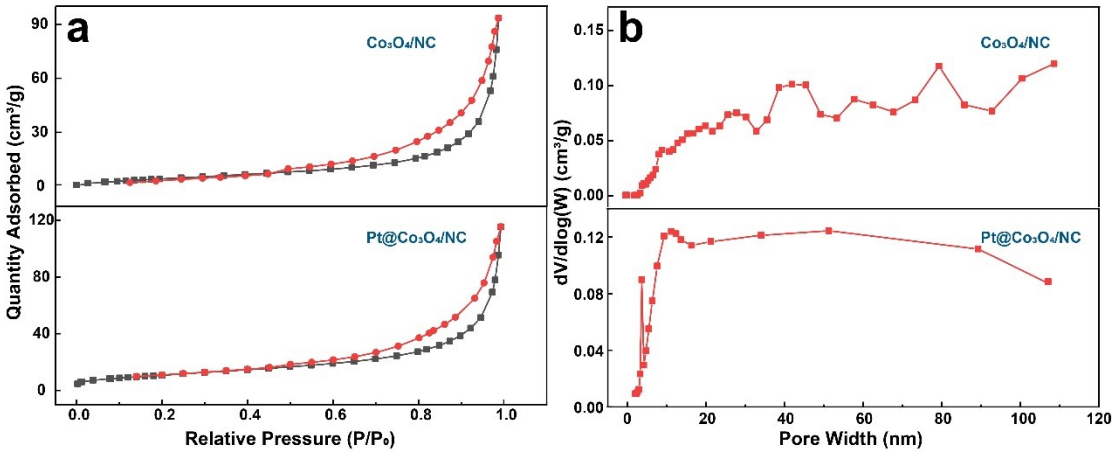

Fig. S3. (a) Nitrogen adsorption-desorption isotherms, and (b) pore size distributions of Co_3O_4/NC and Pt@Co_3O_4/NC.

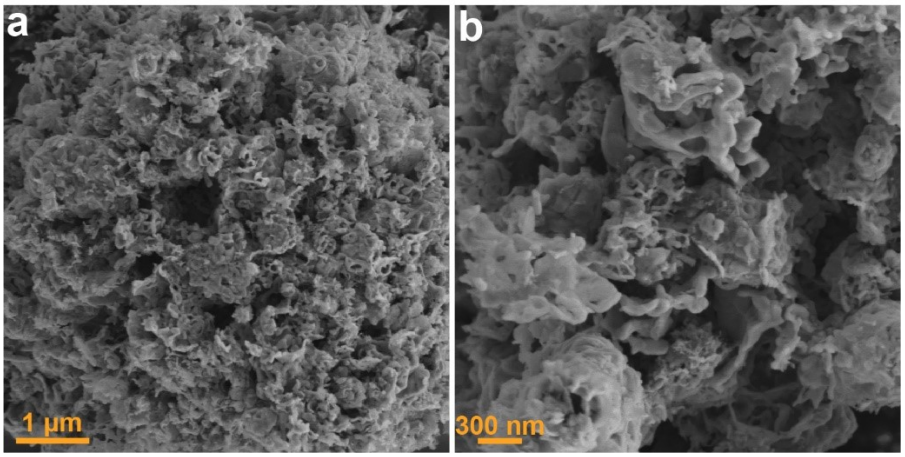

Fig. S4. (a,b) SEM images of Co_3O_4/NC.

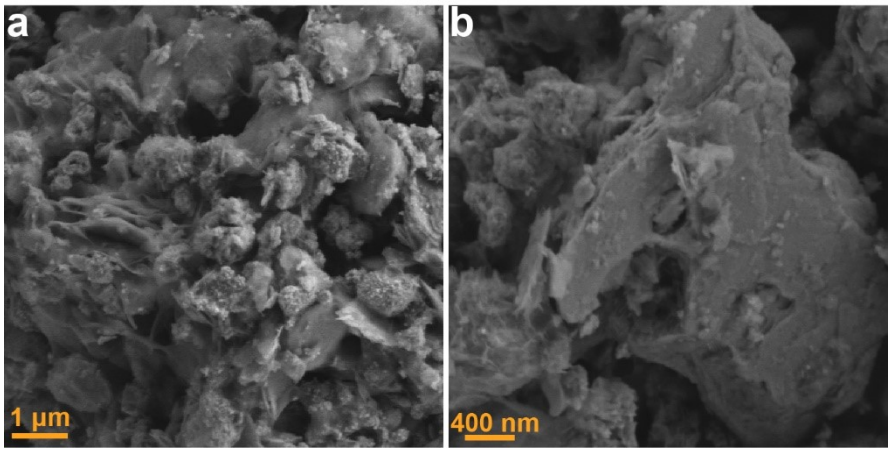

Fig. S5. (a,b) SEM images of contrastive sample Pt@Co_3O_4.

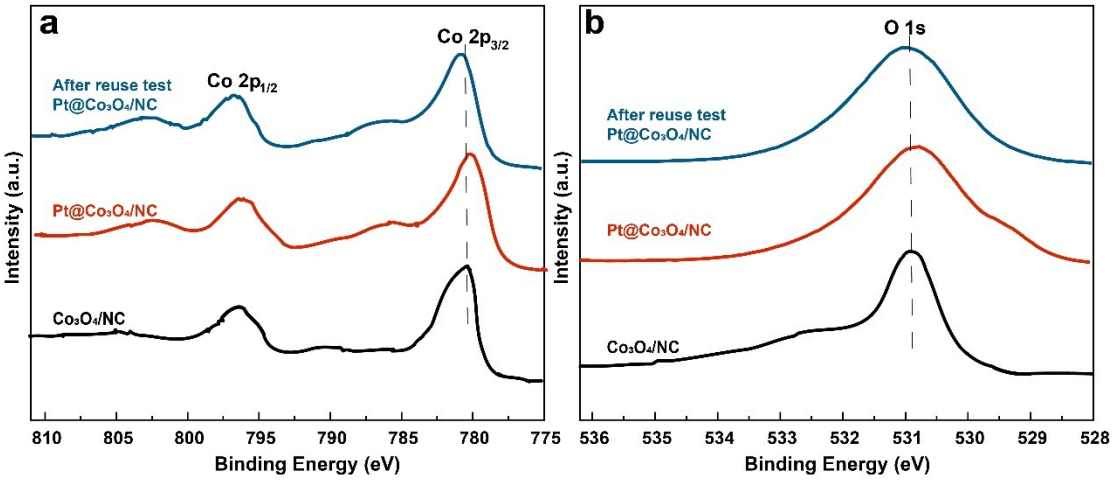

Fig. S6. High-resolution Co 2p (a) and O 1s (b) XPS scan of the pure Co_3O_4/NC and Pt@Co_3O_4/NC before and after the reuse test.

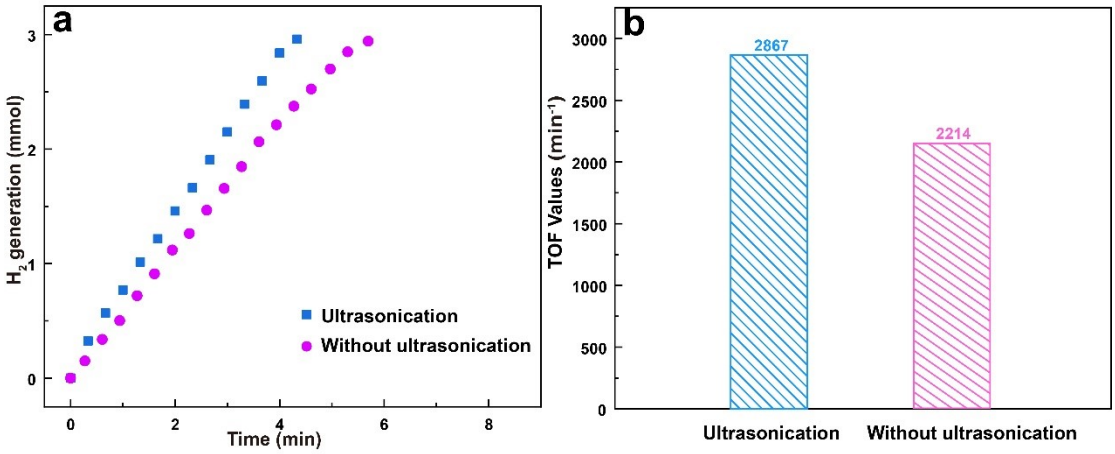

Fig. S7. (a) H_2 generation vs time graph under different operating methods for AB hydrolysis at 298 K and (b) the corresponding TOF values of (a).

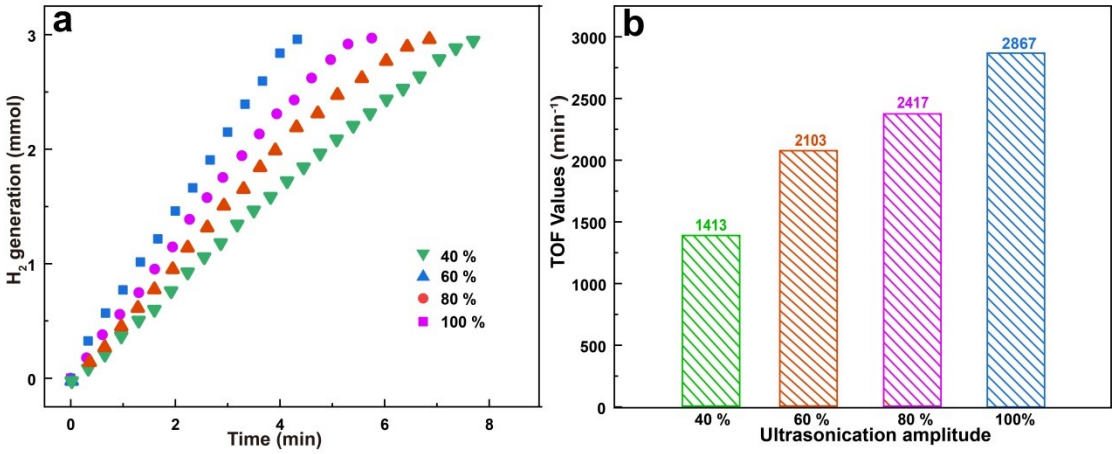

Fig. S8. (a) Time dependences of hydrogen production from hydrolytic dehydrogenation of AB at varied ultrasonication amplitudes and (b) the corresponding TOF values of (a).

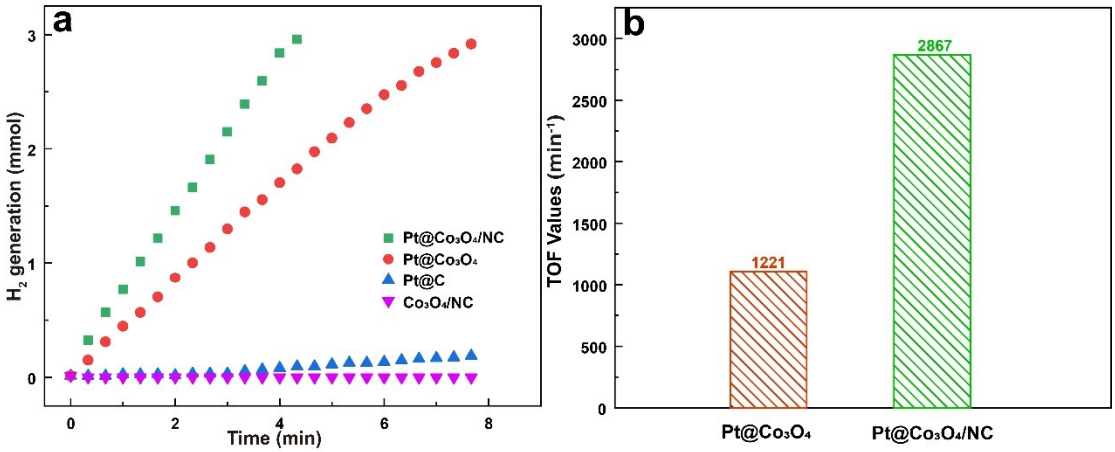

Fig. S9. (a) H_2 generation vs time graph over different catalysts for AB hydrolysis at 298 K and (b) the corresponding TOF values of (a).

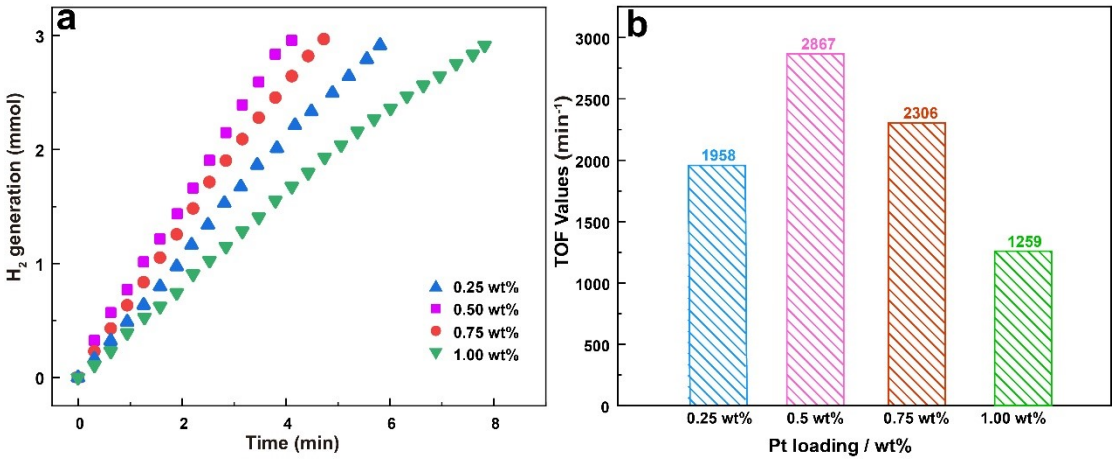

Fig. S10. (a) Effect of catalyst loadings on the catalytic activity of Pt@Co_3O_4/NC. (b) Corresponding TOF values of (a).

Table S1. Comparison of catalytic activity, activation energy, and durability of Pt-based catalysts during the AB hydrolysis.

Catalysts	TOF (min^{-1})	Ea ($kJ \cdot mol^{-1}$)	Recycling times	Retained activity (%)	Refs.
$Pt@SiO_2$	158.6	53.9	5	-	[1]
Pt@MIL-101	414	40.7	-	-	[2]
Pt(8%)/CCF-500	35	39.2	5	47%	[3]
Pt20/CNT	416.5	48.3	4	40%	[4]
Pt/CNT-10W	558	29	5	68%	[5]
Pt/C	111	-	-	-	[6]
Pt/CNT-P	141.7	-	5	24%	[7]
$Pt\text{-}CeO_2$	133	-	5	66%	[8]
$Pt25@TiO_2$	311	-	3	75%	[9]
Pt/CeO_2/RGO	48	-	5	90%	[10]
Pt/CNTs-O-HT	468	-	-	-	[11]
Pd–Pt alloy	51.9	-	5	-	[12]
$PtNi@SiO_2$	20.7	54.76	5	73%	[13]
$Pt\text{-}CoCu@SiO_2$	272.8	51.01	6	-	[14]
$Pt_{0.65}Ni_{0.35}$	44.3	39	-	-	[15]
SiO_2@Pt@NGO	324.6	-	6	58%	[16]
Pt-PVP/SiO_2(M)	371	46.2	5	-	[17]
Pt–Ru@PVP NPs	308	56.3	5	72%	[18]
Pd–Pt@PVP NPs	125	51.7	5	61%	[19]

$Co_{0.32}Pt_{0.68}$/C	67	41.5	-	-	[20]
NP–$Pt_{40}Co_{60}$	131	38.8	5	65%	[21]
PtRu	59.6	38.9	5	70%	[22]
$Pt_{58}Ni_{33}Au_9$	496	-	5	-	[23]
Pt/graphene	107	-	5	81.2%	[24]
Pt@PC-POPs	55	-	5	-	[25]
Pt@CF-12	139	31	7	24%	[26]
Pt@Co_3O_4/NC	**2867**	**32.09**	**10**	**85%**	**This work**

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