Supplementary Information (SI) for Physical Chemistry Chemical Physics.

Green and efficient catalytic oxidation of ethylbenzene to acetophenone over cobalt oxide supported on carbon material derived from sugar

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2. Experimental section

2.1. Catalyst preparation

Table S1 Primary materials in the experiment

Chemicals	Chemical formula	Purity	Sources of Chemicals
cobalt acetate	$(CH_3COOH)_2Co\cdot4H_2O$	AR	Sinopharm Chemical Co.,Ltd.
acetic acid	CH_3COOH	AR	Sinopharm Chemical Co.,Ltd.
acetonitrile	CH_3CN	AR	Sinopharm Chemical Co.,Ltd.
potassium bromide	KBr	AR	Tianjin Kemiou Chemical Reagent Co., Ltd
alcohol	C_2H_5OH	AR	Tianjin Kemiou Chemical Reagent Co., Ltd
hydrochloric acid	HCl	AR	Tianjin Kemiou Chemical Reagent Co., Ltd
ethylbenzene	C_6H_6	AR	Beijing Energy Enginieering Technologies Co.,Ltd.
Hydrogen peroxide	H_2O_2	30%	Xinxing reagent co., ltd.
sugar			Zuoyuan Group Co., Ltd.
edible sugar (production in February 2022)			Nanchang Economic and Technological Development Zone Hongping Food Factory

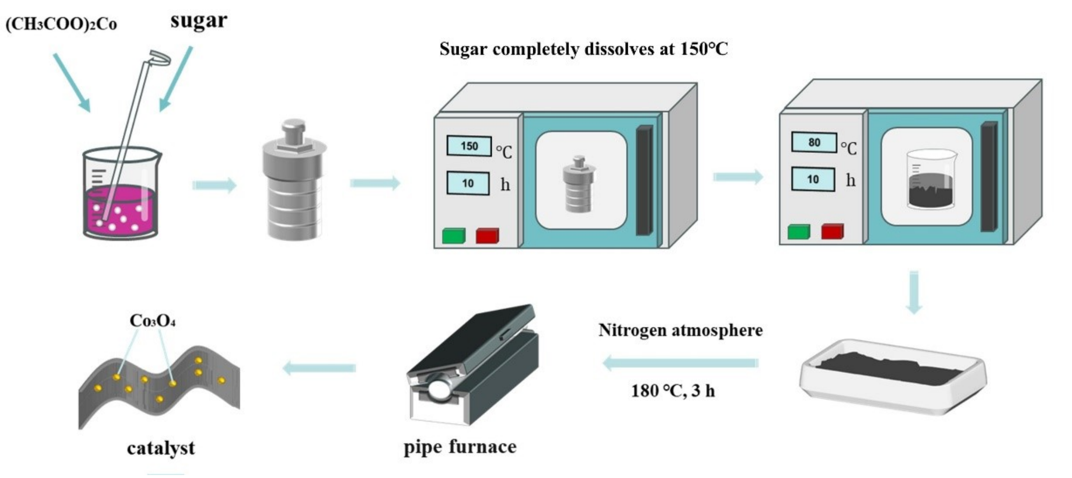

Fig.S1 The preparation process of CoO_x/SC-10-*in situ*.

3. Results and discussion

3.1. Catalyst characterization

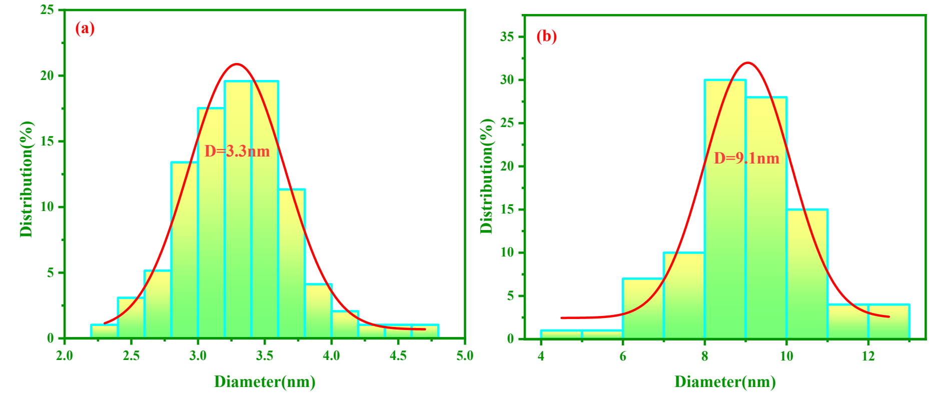

Fig.S2 Particle size distribution of (a)CoO_x/SC-10-*in situ*, (b)CoO_x/SC-10-*im*.

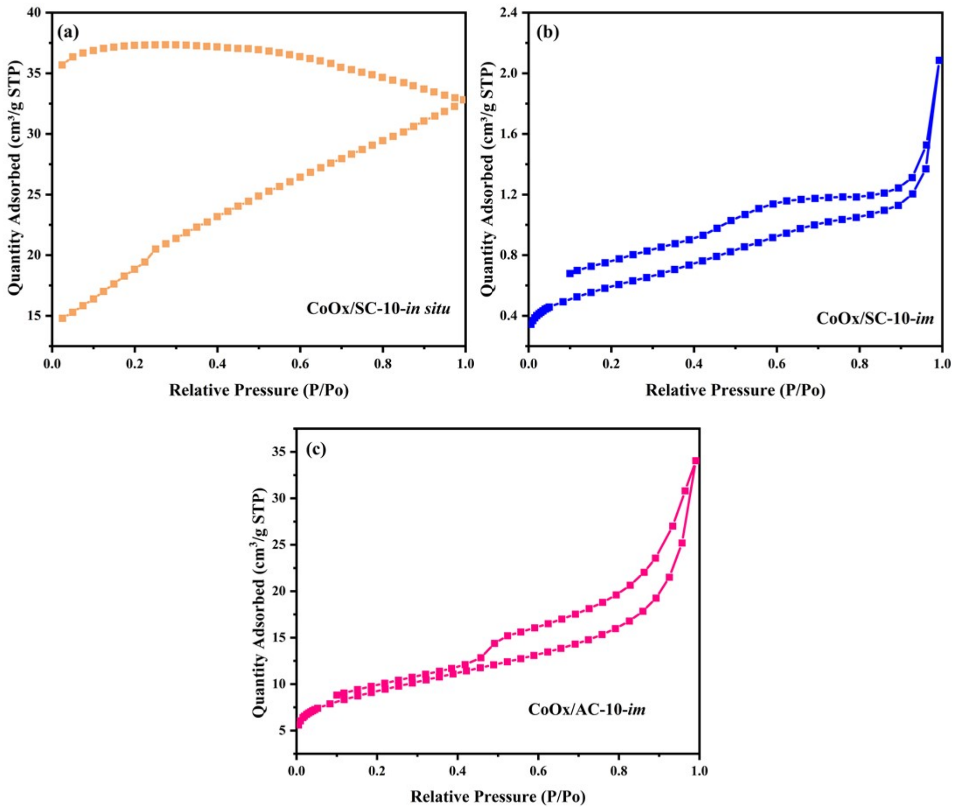

Fig.S3 N_2 adsorption-desorption isotherms of (a) CoO_x/SC-10-*in situ*, (b) CoO_x/SC-10-*im*, (c) CoO_x/AC-10-*im*.

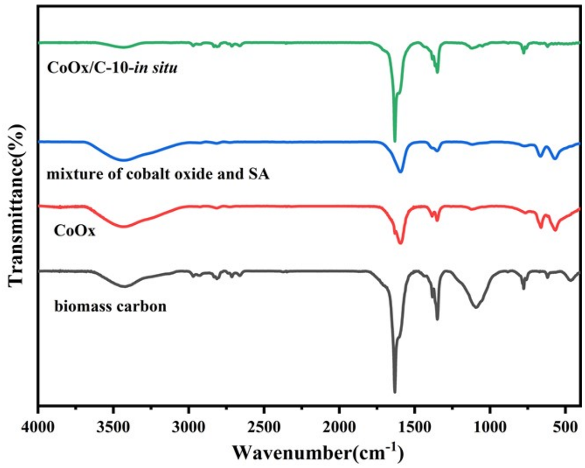

Fig.S4 FT-IR spectra of the samples.

3.2. Evaluation of catalytic oxidation performance

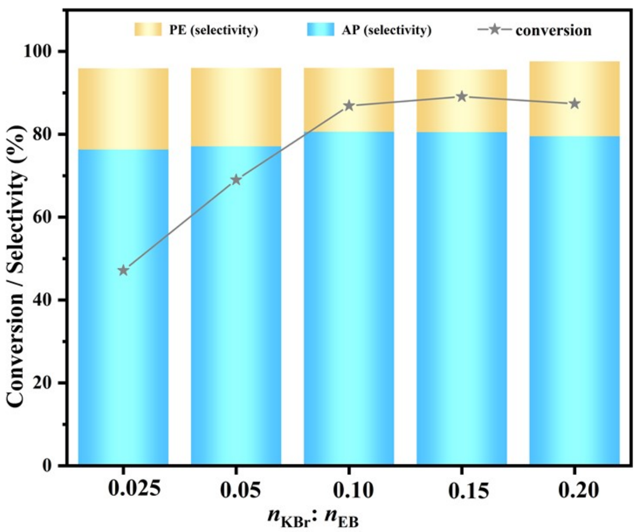

Fig.S5 The effect of the amount of additives (KBr).

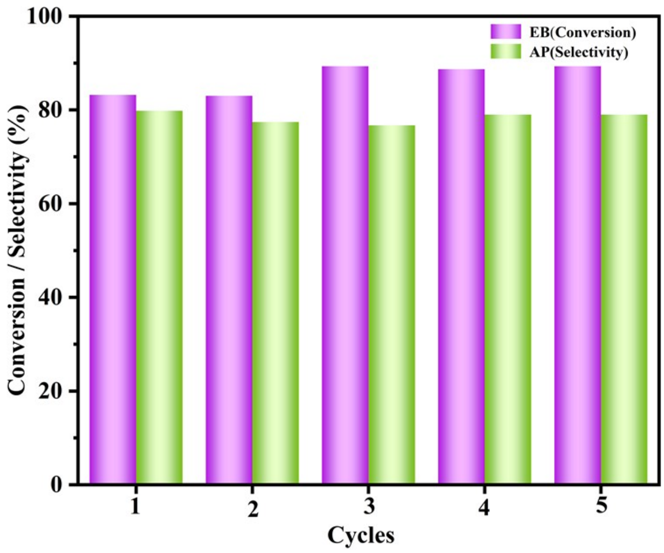

Fig.S6 Reusability of CoO_x/SC-10-*in situ* catalyst for EB oxidation. Reaction conditions: T=80 ℃, $m_{catalys\ t}$: m_{EB}=0.15, n_{H2O2}:n_{EB} :n_{KBr}=14.4: 1 :0.1, t=8 h, V_{EB}:$V_{CH3COOH}$=1:10, n_{EB}=0.1 : 1.

Table S2 Comparison of literature catalysts in the EB oxidation reaction

Entry	Catalyst	solvent	oxidant	Time /h	Temperature/ °C	Con./%(EB)	Sel./%(AP)	Literature
1	Ag/SiO_2	chlorobenzene	TBHP	12	120	38	33.4	1
2	Mn/MCM-41	50 vol.% acetonitrile	TBHP	6	80	57.7	82.2	2
3	SiO_2/Al_2O_3-APTMS-BPK-Co		TBHP	24	80	69	92	3
4	CoO-β		O_2	6	160	34.6	72.9	4
5	Co-N-S-C-700		O_2	5	120	48	85	5
6	Co/AC-salen-400		TBHP	4	80	47.9	83.5	6
7	Co-MCM-41(100)		TBHP	24	80	26	85	1
8	Ni/13USY		O_2	5	150	21.4	76.5	7

3.3. Reaction mechanism

Table S3 The activity data of EB oxidation in different solvents using CoO_x/SC-10-*in situ*.

Entry	solvent	Con.[a] (%)	Sel.[b] (%)
1	2.5mL acetic acid	75.12	81.06
2	2.5mL acetic acid and 1.5mL alcohol	73.27	55.82
3	2.5mL alcohol	17.24	12.53
4	2.5mL acetonitrile		
5	2.5mL acetonitrile and 0.02mLHCl(12mol/L)	66.61	73.56

Reaction conditions: T=80 °C, $m_{catalyst} : m_{EB}$=0.15, t=4 h, $V_{EB}:V_{CH_3COOH}$=1:10, $n_{H_2O_2}:n_{KBr} : n_{EB}$=0.1 : 1. [a] Conversion of EB. [b] Selectivity of AP.

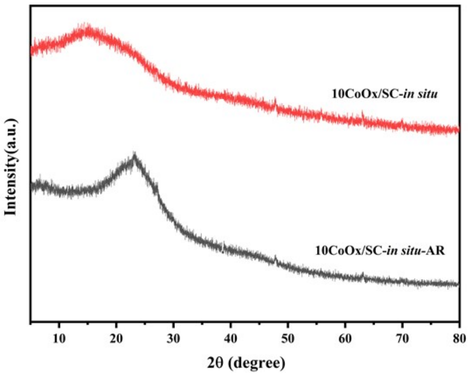

Fig.S7 XRD patterns of CoO_x/SC-10-*in situ* and CoO_x/SC-10-*in situ*-AR.

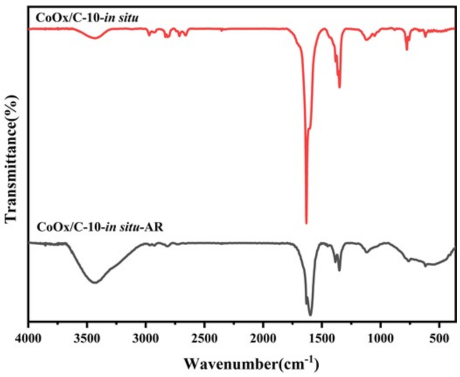

Fig.S8 FT-IR spectra of CoO_x/SC-10-*in situ* and CoO_x/SC-10-*in situ*-AR.

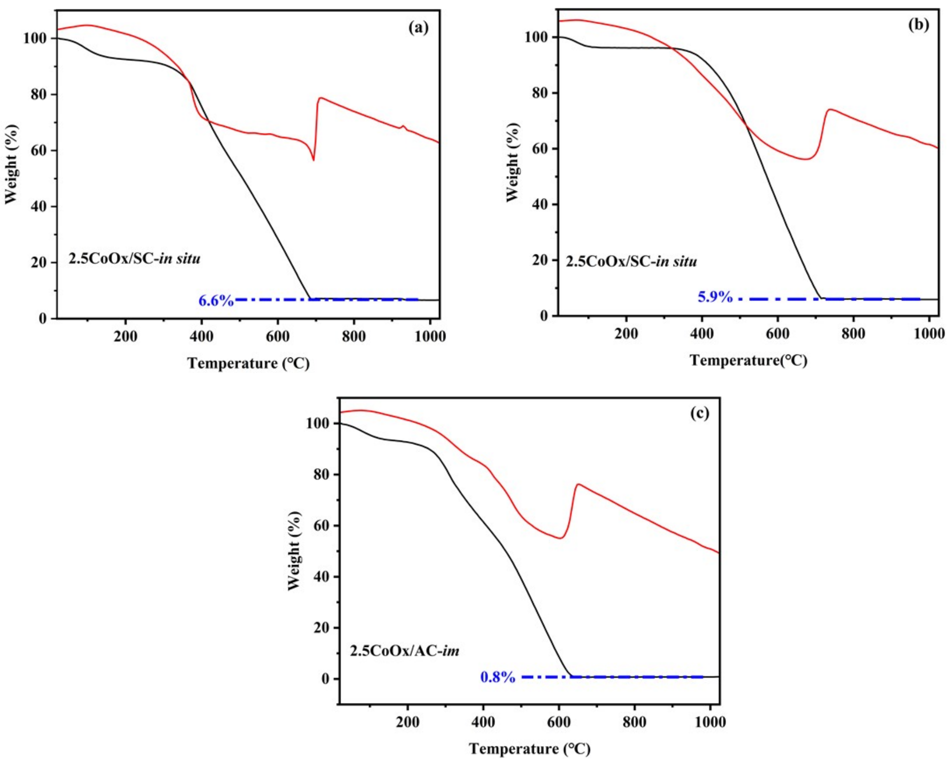

Fig.S9 TG-DSC curves of different samples (a)2.5CoO_x/SC-*in situ*, (b) 2.5CoO_x/SC-*im*, (c) 2.5CoO_x/AC-*im*.

Notes and references

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