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Supplementary Information for

Compositional dependence of Co- and Mo-supported Beta zeolite for selective one-step hydrotreatment of methyl palmitate to produce bio jet fuel range hydrocarbons

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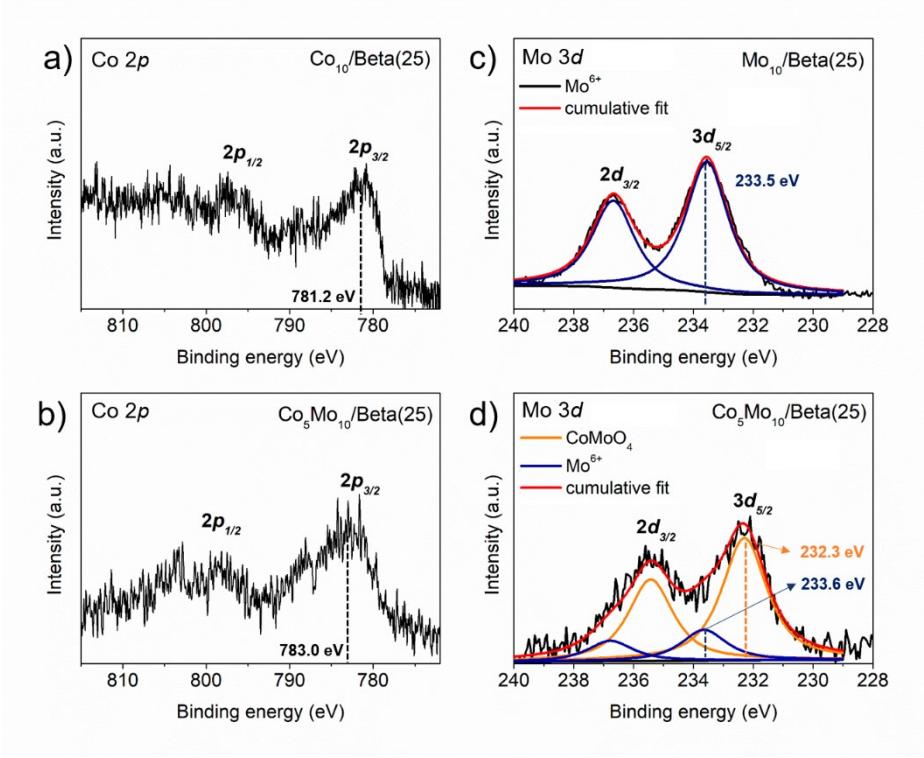

Fig. S1. XPS of Co 2p for (a) Co_{10}/Beta(25) and (b) Co_5Mo_{10}/Beta(25), and Mo 3d for (c) Mo_{10}/Beta(25) and (d) Co_5Mo_{10}/Beta(25). All the samples were obtained after the wet-impregnation and subsequent calcination.

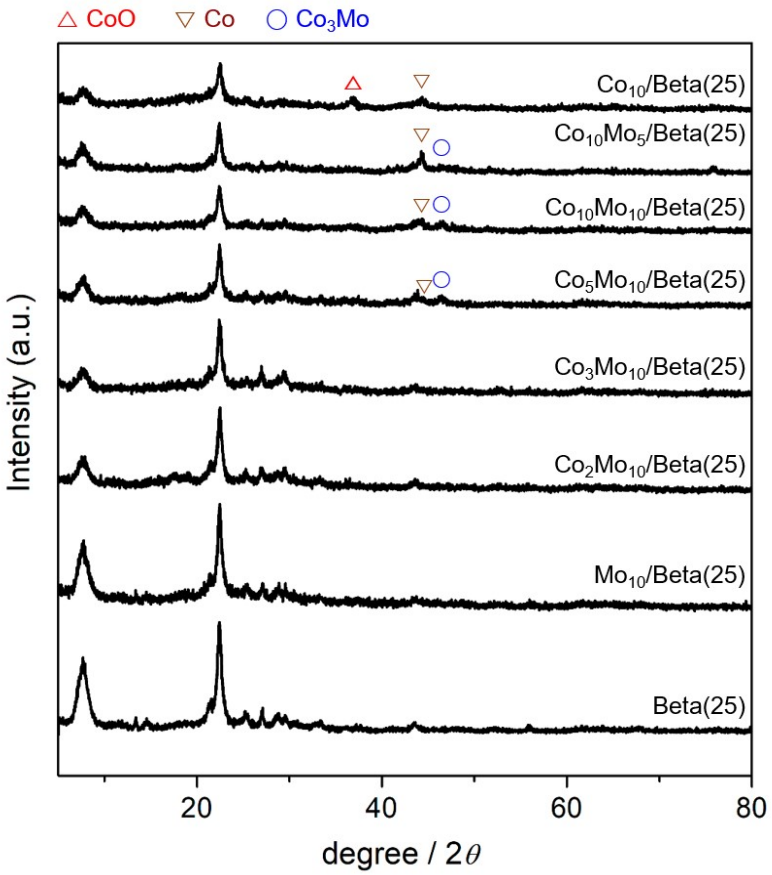

Fig. S2. XRD patterns of the Co- or/and Mo-supported Beta(25) and Beta(25) zeolite after the reduction under the same pretreatment condition of the catalytic reaction test. The positions of characteristic peaks are referenced from the JCPDS database (CoO: PDF#04-001-8626, Co: PDF#01-077-7456, Co_3Mo: PDF#04-004-3529).

Table S1. Physical properties of Co- or/and Mo-supported Beta(25) and Beta(25) zeolite after the reduction under the same pretreatment condition of the catalytic reaction test.

Sample	Surface area (BET) (m^2/g)			Pore volume (cm^3/g)		
	Total[a]	Micropore[b]	Mesopore[b]	Total	Micropore[b]	Mesopore[b]
Co_{10}/Beta(25)	452	312	140	0.51	0.12	0.39
$Co_{10}Mo_5$/Beta(25)	466	320	146	0.63	0.13	0.50
$Co_{10}Mo_{10}$/Beta(25)	449	312	137	0.54	0.12	0.42
Co_5Mo_{10}/Beta(25)	447	312	135	0.57	0.12	0.45
Co_3Mo_{10}/Beta(25)	456	318	138	0.57	0.13	0.44
Co_2Mo_{10}/Beta(25)	444	296	148	0.62	0.12	0.50
Mo_{10}/Beta(25)	443	283	150	0.66	0.11	0.55
Beta(25)	643	439	204	0.79	0.18	0.61

[a] Total surface area was determined by N_2 adsorption and calculated by BET method.

[b] Surface area and volume of micropore and mesopore were determined by t-plot method.

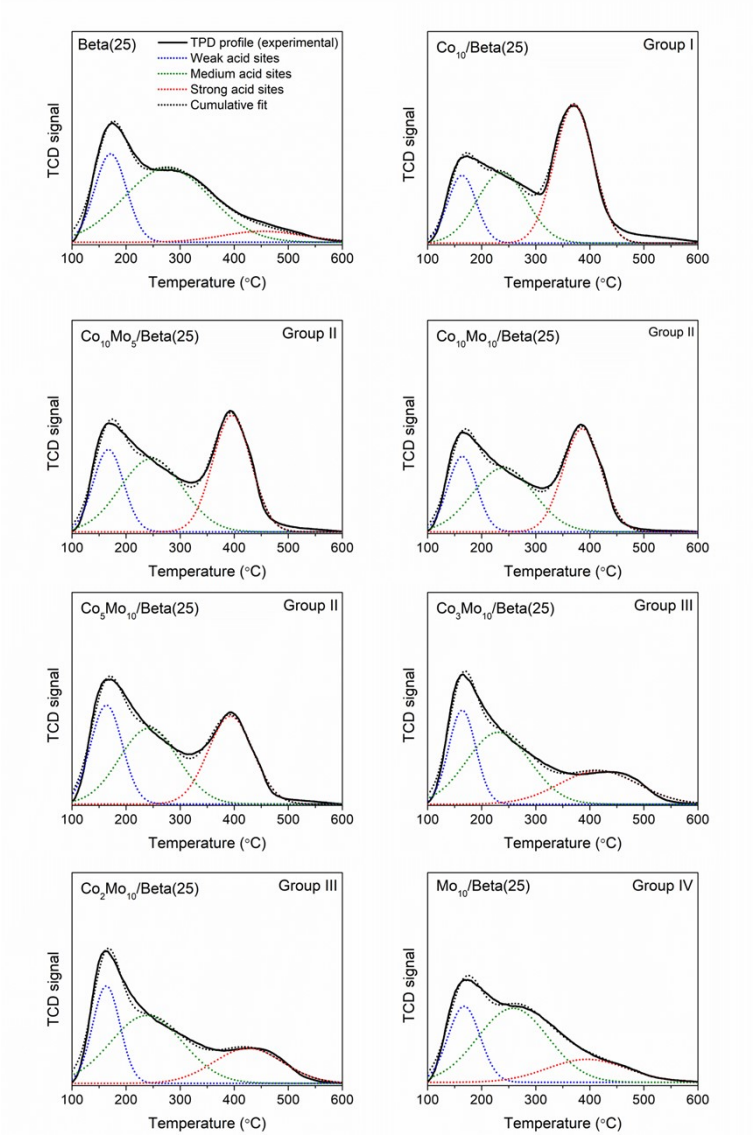

Fig. S3. NH_3-TPD profiles and the corresponding deconvolution results by the Gaussian curve fitting method.

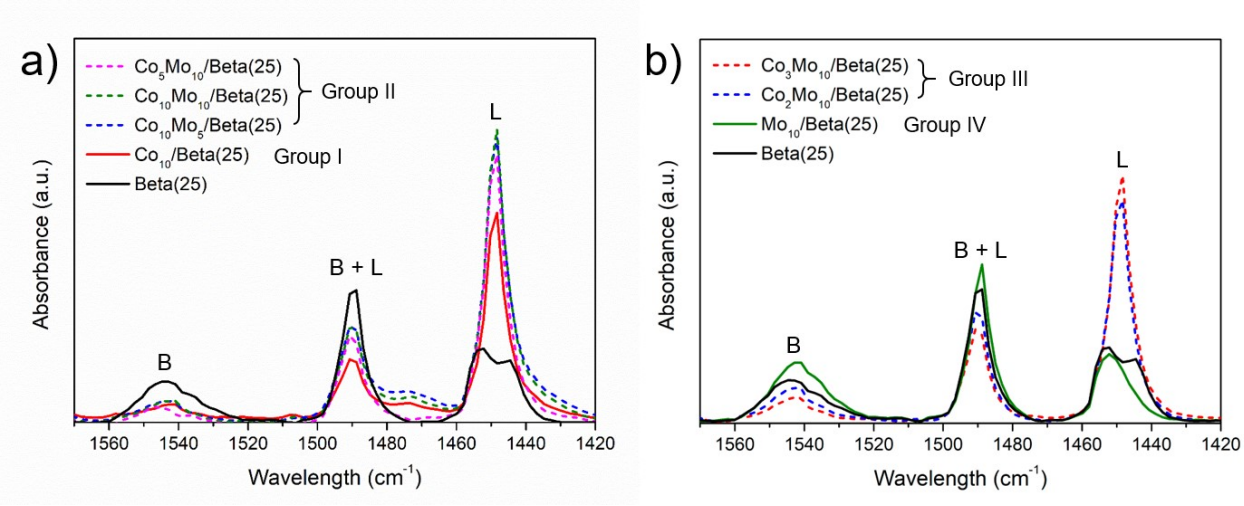

Fig. S4. FTIR spectra of adsorbed pyridine of catalysts after the reduction under the same pretreatment condition of the catalytic reaction test; (a) Co_{10}/Beta(25), $Co_{10}Mo_5$/Beta(25), $Co_{10}Mo_{10}$/Beta(25), Co_5Mo_{10}/Beta(25), and Beta(25), and (b) Mo_{10}/Beta(25), Co_2Mo_{10}/Beta(25), Co_3Mo_{10}/Beta(25), and Beta(25), which are separately classified according to the combination of metal phases.

Table S2. Catalytic activities of the zeolite-based catalysts for bio jet fuel range hydrocarbons from FAMEs.

Catalysts	Feed	Reactor	T (°C)	P (bar)	Conversion (%)	Selectivity for jet fuel range (%)	Isomerization (%)	Ref
Co_5Mo_{10}/Beta(25)	**Methyl palmitate**	**semi-batch**	**280**	**20**	**94.2**	**89.7 wt% (C_8–C_{16})**	**83.8 (C_8–C_{16})**	**This work**
Ni/desilicated meso Y zeolite	Methyl palmitate	batch	390	20	-	64.8 (C_8–C_{16})	19.4 (C_8–C_{16})	*Fuel* **2019**, *244*, 472.
10wt%Ni/Beta zeolite	Methyl laurate	batch	280	20	81.1	37.7 (C_{11}–C_{12})	-	*Fuel Process. Technol*. **2023**, *241*, 107602
PtNi@hierarchical silicalite-1 zeolite	Methyl stearate	fixed -bed	360	30	100	45 (C_9–C_{15})	-	*Ind. Eng. Chem. Res*. **2020**, *59*, 8601.
10 wt% Ni/HZSM-5 (Si/Al = 25)	Methyl oleate $C_{18:1}$ (99.0%), methyl octadecanoate $C_{18:0}$ (0.8%), methyl linoleate $C_{18:2}$ (0.2%)	fixed - bed	280	8	85.1	32.5 (C_8–C_{16})	35.4 mol% (C_8–C_{16})	*Catal. Today.* **2016**, *259*, 266.
Ni/meso Y zeolite	Microalgae (FAMEs, C16:1 (35.9%), C16:0 (30.0%), C14:0 (10.7%), C18:1(8.5%))	fixed - bed	275	20	91.5	56.2 (C_8–C_{16})	46.4 (C_5–C_{16}, in liquid products)	*Int. J. Hydrog. Energy.* **2019**, *44*, 11765.
4% $H_3PW_{12}O_4$-10% Ni/meso Y zeolite	Microalgae (FAMEs, including C16:1 (35.9%), C16:0 (30.0%), C14:0 (10.7%), C18:1(8.5%))	fixed -bed	255	20	-	63.1 (C_8–C_{16})	20.5 (C_5–C_{16}, in liquid products)	*Fuel* **2019**, *245*, 384
Ce/Beta zeolite	Algae oil	batch	400	27.5	98	85 (C_{10}–C_{14})	-	*RSC advances*., **2016**, *6*, 14626.

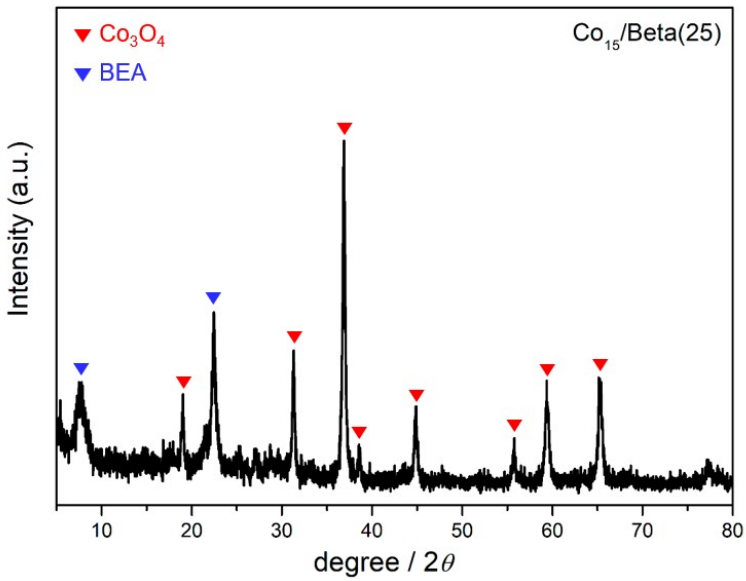

Fig. S5. XRD patterns of Co_{15}/Beta(25) obtained by the wet-impregnation and subsequent calcination. The positions of characteristic peaks are referenced from the JCPDS database (BEA:01-074-8795, Co_3O_4:00-042-1467).

Table S3. Acidic properties of Co_{15}/Beta(25) estimated by NH_3-TPD profiles and FTIR spectra of adsorbed pyridine, and their corresponding crystalline phase confirmed by XRD. Co_{15}/Beta(25) was reduced under the same pretreatment condition of the catalytic reaction test.

Sample	Metal phase	NH_3-TPD							FTIR of adsorbed pyridine		
		Strong acid sites[a]		Medium acid sites[a]		Strong acid sites[a]		Total acid sites (mmol/g)	B[b] (mmol/g)	L[b] (mmol/g)	B/L[b]
		T (°C)	Density (mmol/g)	T (°C)	Density (mmol/g)	T (°C)	Density (mmol/g)				
Co_{15} /Beta(25)	Co_3O_4	164	0.20	233	0.33	359	0.60	1.13	0.05	0.05	1.08

[a] Peak temperature and the corresponing amounts of acid sites calculated from the deconvolution results of NH_3-TPD profiles by the bian curve fitting method (Fig. S2)

b Quantity of Brønsted (B) and Lewis (L) acid sites determined by multiplying the B/L ratio from FTIR spectra of adsorbed pyridine and the total acid sites concentration from NH_3-TPD profiles.

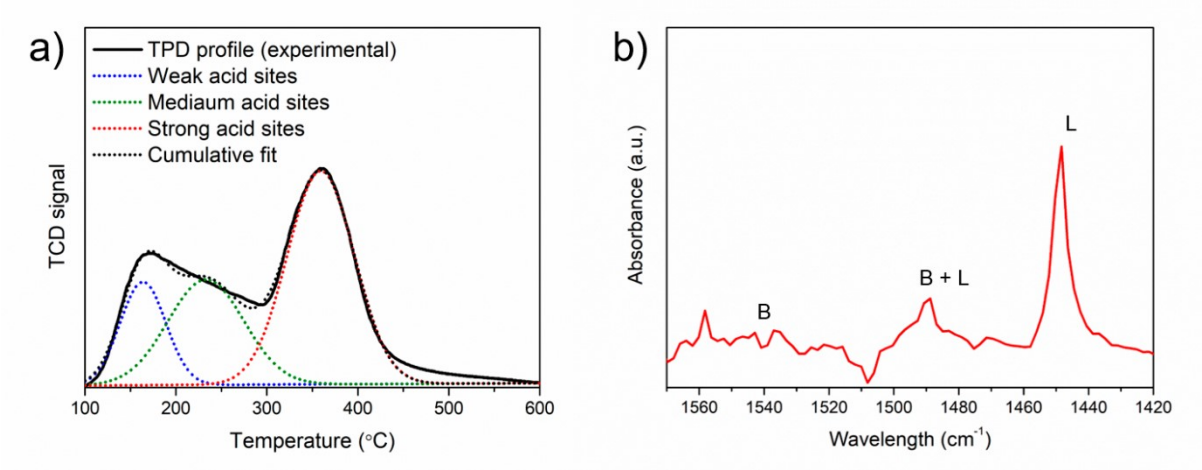

Fig. S6. (a) NH_3-TPD profiles and the corresponding deconvolution results by the Gaussian curve fitting method and (b) FTIR spectra of adsorbed pyridine of Co_{15}/Beta(25) after the reduction under the same pretreatment condition of the catalytic reaction test

Table S4. Catalytic activity of methyl palmitate over the Co_{15}/Beta(25) zeolite catalyst.

Catalyst	Conv. (%)	Gas product	Organic liquid product						Yield of jet fuel range hydrocarbons (C_8-C_{16}, %)	n-C_{16} /(n-C_{15} + n-C_{16})	Isomer ratio in C_8–C_{16} (%)
		Yield (%)	Yield (%)	Selectivity (wt%)							
				C_5–C_7	C_8–C_{16}	C_{17}–C_{18}	$C_{32}H_{64}O_2$	Palmitic acid			
Co_{15}/Beta(25)	100	27.3	72.7	10.4	89.6	0	0	0	65.1	0.74	77.7