Effective deoxygenation of fatty acids over $Ni(OAc)_2$ in the absence of H_2 and solvent

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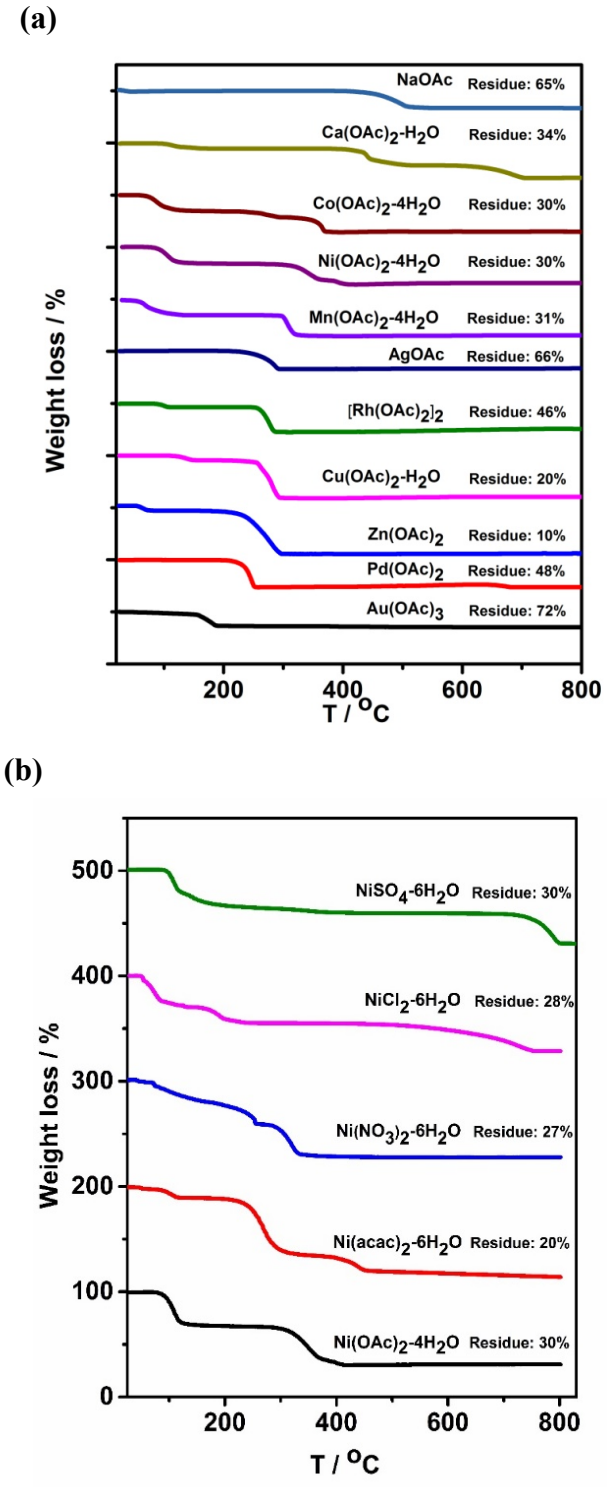


Fig. S1 Thermogravimetric analysis under N_2 flow. (a) different acetate salts; (b) different nickel salts.

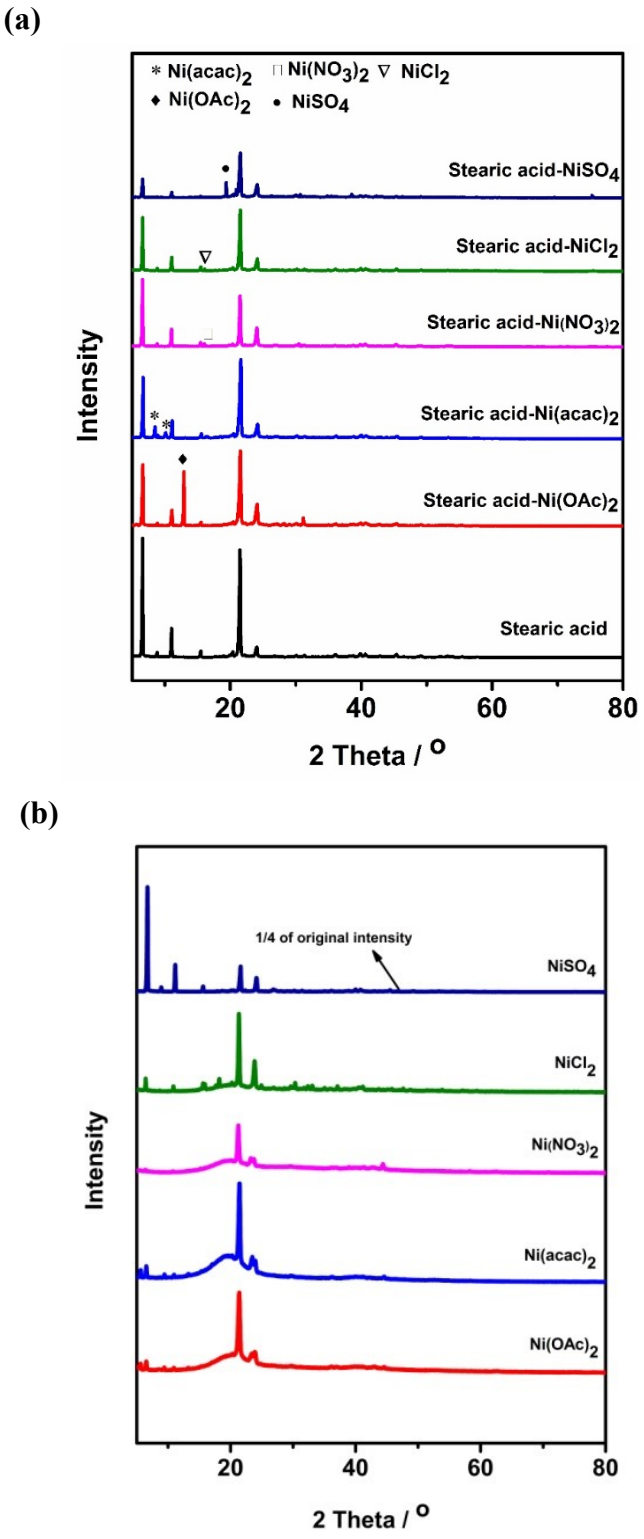


Fig. S2 XRD patterns of different nickel salts with stearic acid. (a) before reaction; (b) after reaction.

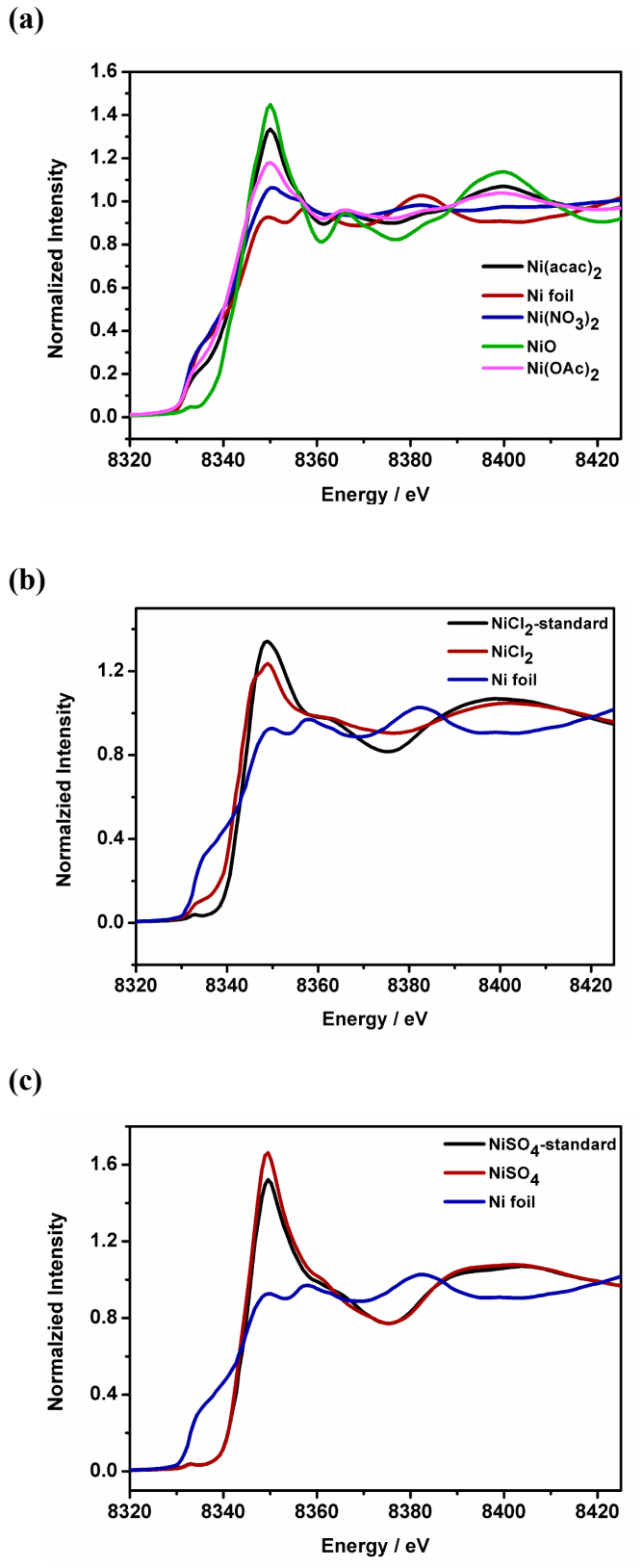
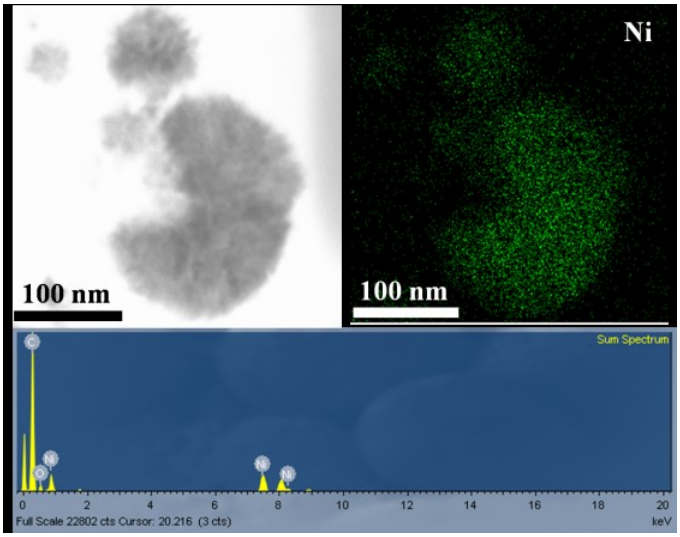
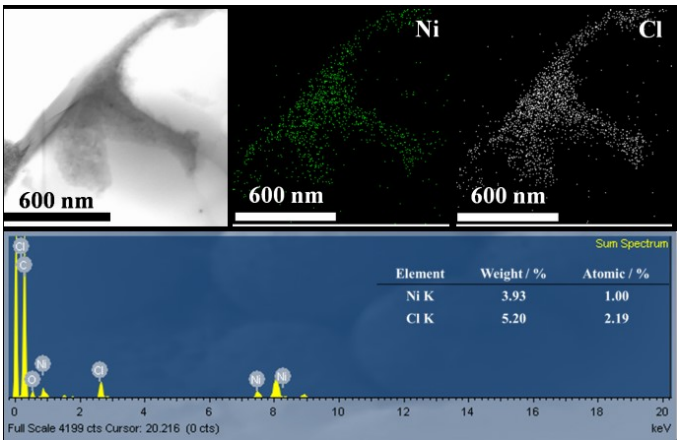


Fig. S3 XAS spectra of different nickel slats. (a) $Ni(OAc)_2$, $Ni(acac)_2$ and $Ni(NO_3)_2$ catalytic systems; (b) $NiCl_2$ catalytic system; (c) $NiSO_4$ catalytic system.

(a)



(b)



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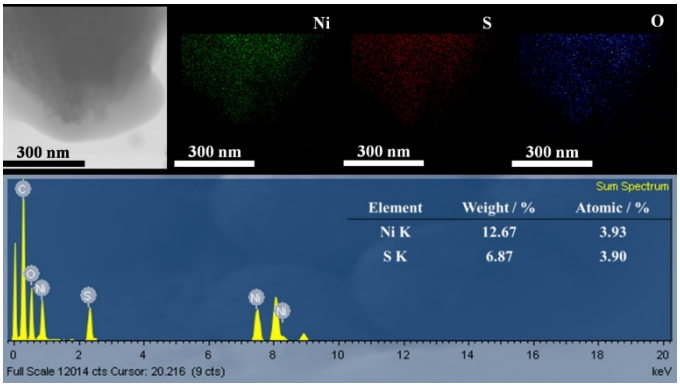
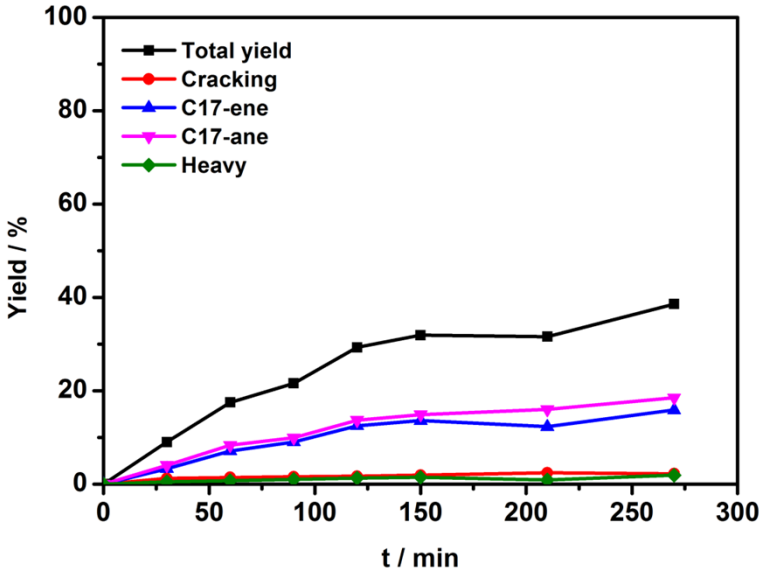


Fig. S4 TEM images and element mapping of different nickel salts after reaction with stearic acid. (a)$Ni(OAc)_2$; (b) $NiCl_2$; (c)$NiSO_4$.

(a)



(b)

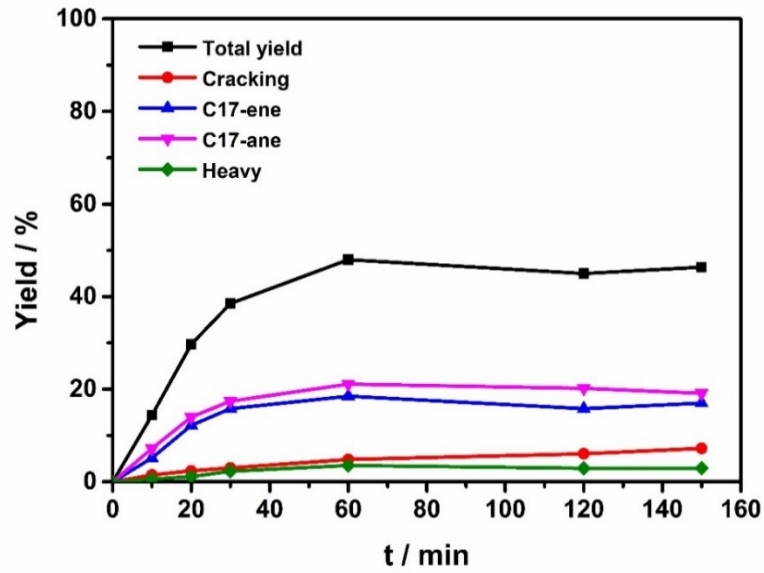


Fig. S5 The variation of product yields with time under different temperatures. (a) Product yield with time at 330 ℃; (b) Product yield with time at 370 ℃.

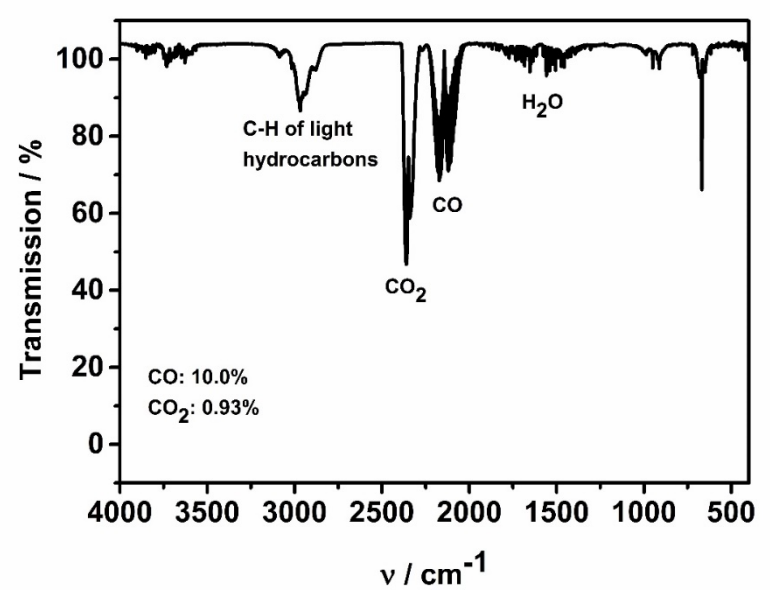


Fig. S6 FT-IR spectra of gas products.

Table S1. Catalytic activity of stearic acid deoxygenation without catalyst under different temperatures [a]

Entry	Catalyst	GC yield / %[b]						HPLC Conv. /%[c]
		Cracking product	Heptadecene	Heptadecane	Stearaldehyde	Heavy product	Total	
1	330-blank	0.49	0.44	0.62	0.34	0.42	2.32	6.89
2	370-blank	7.74	0.39	0.67	0.17	1.46	10.4	21.2
3	390-blank	15.6	1.11	2.37	0.08	0.51	19.6	31.0

[a] Reaction conditions: stearic acid (200 mg); T = 350 ℃; t = 2 h. [b] Determined by GC and calculated according to effective carbon number with dodecane as internal standard. Cracking: C8-C16 alkenes and alkanes; Heavy product: 2-C19-one and stearone; -: not detected. [c] Determined by HPLC.

Table S2. Catalytic activity of different nickel based catalysts on the deoxygenation of stearic acid [a]

Entry	Catalyst	GC yield / %[b]						HPLC conv./% [c]
		Cracking product	Heptadecene	Heptadecane	Stearaldehyde	Heavy product	Total	
1 [d]	$Ni(OAc)_2$-$Au(OAc)_3$	4.40	18.9	25.1	-	2.55	51.0	62.1
2 [d]	$Ni(OAc)_2$-$Co(OAc)_2$	3.83	18.2	22.9	-	14.7	59.7	77.1
3 [d]	$Ni(OAc)_2$-$Mn(OAc)_2$	3.98	18.2	24.2	-	11.9	58.3	81.2
4 [d]	$Ni(OAc)_2$-$Zn(OAc)_2$	3.98	17.1	23.4	-	8.58	53.0	-
5 [d]	$Ni(OAc)_2$-$Cu(OAc)_2$	5.11	18.1	22.6	-	2.46	48.3	64.9
6 [d]	$Ni(OAc)_2$-AgOAc	5.07	15.6	20.3	-	1.32	42.3	53.8
7 [e]	$Ni(OAc)_2$-$Co(OAc)_2$(8:2)	4.38	19.9	25.2	-	9.02	58.4	-
8 [e]	$Ni(OAc)_2$-$Cu(OAc)_2$ (8:2)	6.41	19.1	24.4	-	4.35	54.3	-

[a] Reaction conditions: stearic acid (200 mg); T = 350 ℃; t = 3.5 h. [b] Determined by GC and calculated according to effective carbon number with dodecane as internal standard. Cracking: C8-C16 alkenes and alkanes; Heavy product: 2-C19-one and stearone; -: not detected. [c] Determined by HPLC. [d] $Ni(OAc)_2$ (1 mol%), other acetate salts (1 mg). [e] The molar ratio of Ni: Co and Ni: Cu was 8:2. These two materials were prepared by dissolving two acetate salts in water and then free dried for use.

Table S3. Deoxygenation rate constants under different reaction temperatures

T / ℃	Rate constant / × 10^{-4} s^{-1}	Linear fitting R^2
330	0.7267	0.9976
350	1.81	0.9690
370	3.498	0.9770
390	5.478	0.8401