Electronic Supplementary Material (ESI) for Green Chemistry
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Supporting Information to

Enhanced hydrogenation of ethyl levulinate to γ-valerolactone and ethyl pentanoate by Pd/AC doped with Nb_2O_5

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1. Characterization

1.1 BET

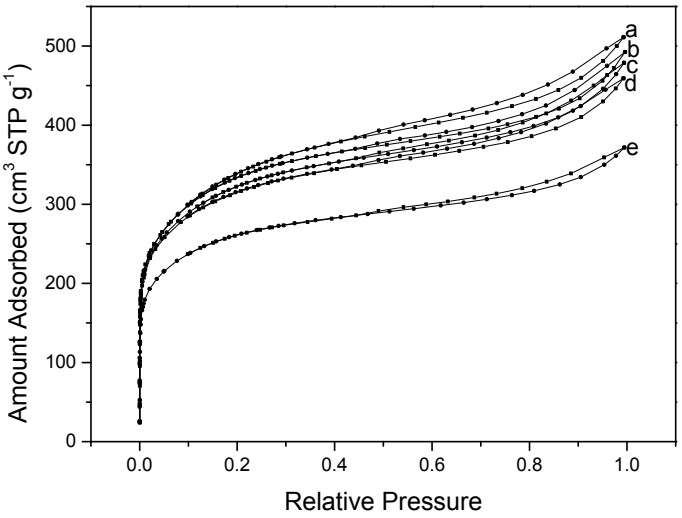

Figure S1. Nitrogen adsorption isotherms of xNb-500-AC catalysts with different loading of niobium oxide: (a) 0 wt. %; (b) 2.5 wt. %; (c) 5 wt. %; (d) 10 wt. %; (e) 20 wt. %.

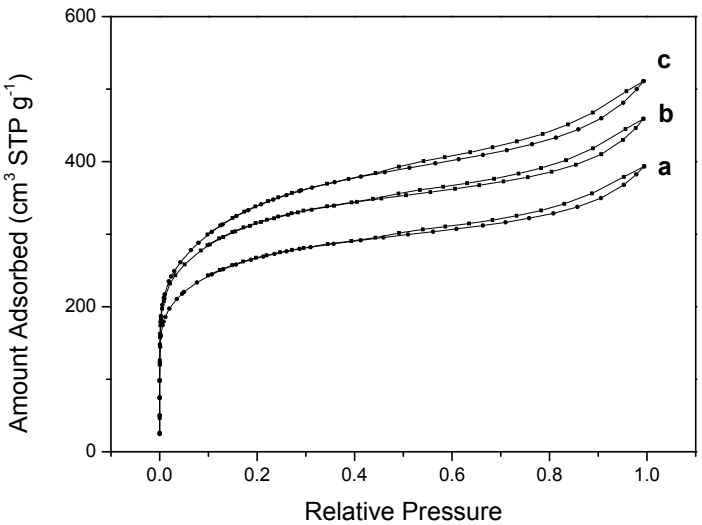

Figure S2. Nitrogen adsorption isotherms of 10Nb-y-AC catalysts with different calcination temperature of niobium oxide: (a) 300 °C; (b) 500 °C ; (c) 700 °C.

1.2 EDX

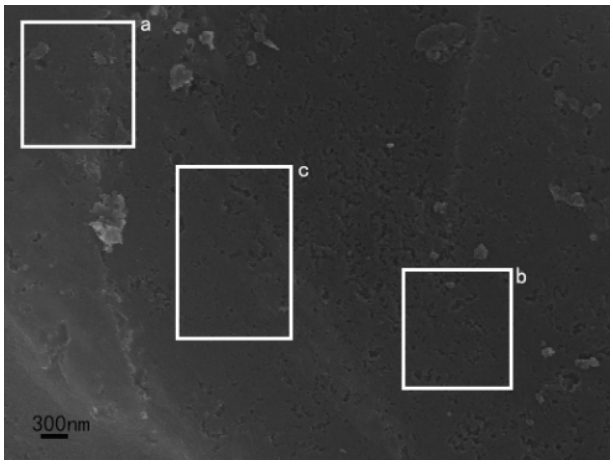

Figure S3. SEM image of 10Nb-500-AC. Results of EDX measurement are given in **Table S1**.

Table S1. EDX measurements (in weight %) of 10Nb-500-AC.

10Nb-500-AC					
EDX point	Nb	O	C	Al	Si
a	5.0	6.0	88.6	0.1	0.2
b	4.8	5.9	89.1	0.1	0.0
c	5.0	5.7	88.9	0.1	0.3

1.3 XRD

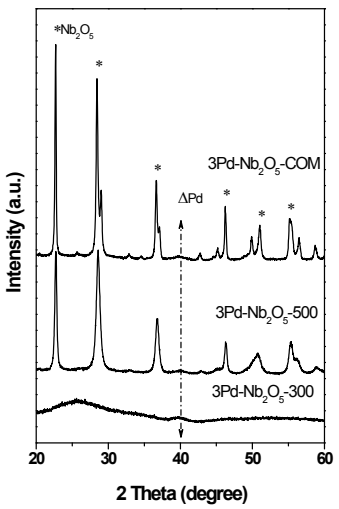

Figure S4. XRD patterns of 3Pd-Nb_2O_5 catalysts.

2 Catalytic Tests

Table S2. Hydrogenation activities of Pd-AC and 3Pd-10Nb-500-AC for EL and LA.

Catalyst	Substrate	Conv. EL/LA (%)	Sel. (%)		
			LA	GVL	EHP
3Pd-AC	EL[a]	38	3	74	23
	LA[b]	20	-	100	-
3Pd-10Nb-500-AC	EL[a]	87	2	93	5
	LA[b]	62	-	100	-

[a] Reaction conditions: 10 ml of 0.25 M EL aqueous solution; 0.5 MPa H_2; 100 °C; 25 mg catalyst (3 wt.% Pd); 5 h; 800 rpm.

[b] Reaction conditions: 10 ml of 0.25 M LA aqueous solution; 0.5 MPa H_2; 100 °C; 25 mg catalyst (3 wt.% Pd); 5 h; 800 rpm.

Table S3. Hydrogenation of EL by Pd-Nb_2O_5 catalysts.

Catalysts[a]	Conv. EL
Pd-Nb_2O_5-COM	2
Pd-Nb_2O_5-300	2
Pd-Nb_2O_5-500	1

[a] Reaction conditions: 10 ml of 0.25 M EL aqueous solution; 0.5 MPa H_2; 100 °C; 25 mg catalyst (3 wt.% Pd); 5 h; 800 rpm.

Table S4. Activities of AC and 10Nb-y-AC supports in EL hydrolysis and EHP dealcoholization.

Substrate	Catalyst	Conv. (%)
EL[a]	AC	1
	10Nb-300-AC	3
	10Nb-500-AC	5
	10Nb-700-AC	1
EHP[b]	AC	51
	10Nb-300-AC	86
	10Nb-500-AC	90
	10Nb-700-AC	56

[a] Hydrolysis of EL. Reaction conditions: 10 ml of 0.25 M EL aqueous solution; 0.5 MPa N_2; 100 °C; 25 mg catalyst; 5 h.

[b] Dealcoholization of EHP. Reaction conditions: 10 ml of 0.25 M EHP aqueous solution; 0.5 MPa N_2; 100 °C; 25 mg catalyst; 5 h.

