

**Supporting Information for**

**Co-Ni alloy nanoparticles on La-doped-SiO<sub>2</sub> for direct ethanol synthesis from  
syngas**

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Supporting Information

**Figure S1** Optical photos of the prepared catalysts of LaCo<sub>1-x</sub>Ni<sub>x</sub>O<sub>3</sub>/SiO<sub>2</sub> ( $x = 0, 0.6 - 0.8, 1$ ) and SiO<sub>2</sub>.

**Table S1** Physical properties of the catalysts of LaCo<sub>1-x</sub>Ni<sub>x</sub>O<sub>3</sub>/SiO<sub>2</sub> ( $x = 0, 0.6 - 0.8, 1$ ) and SiO<sub>2</sub>.

**Figure S2** TPR profiles of the catalysts of LaCo<sub>1-x</sub>Ni<sub>x</sub>O<sub>3</sub>/SiO<sub>2</sub> ( $x = 0, 0.6 - 0.8, 1$ ).

**Figure S3** The distributions of alcohols (a) and hydrocarbons (b) over the catalysts of LaCo<sub>1-x</sub>Ni<sub>x</sub>O<sub>3</sub>/SiO<sub>2</sub> ( $x = 0.6, 0.7, 0.8$ ), (□)  $x = 0.6$ , (▨)  $x = 0.7$  and (■)  $x = 0.8$ .

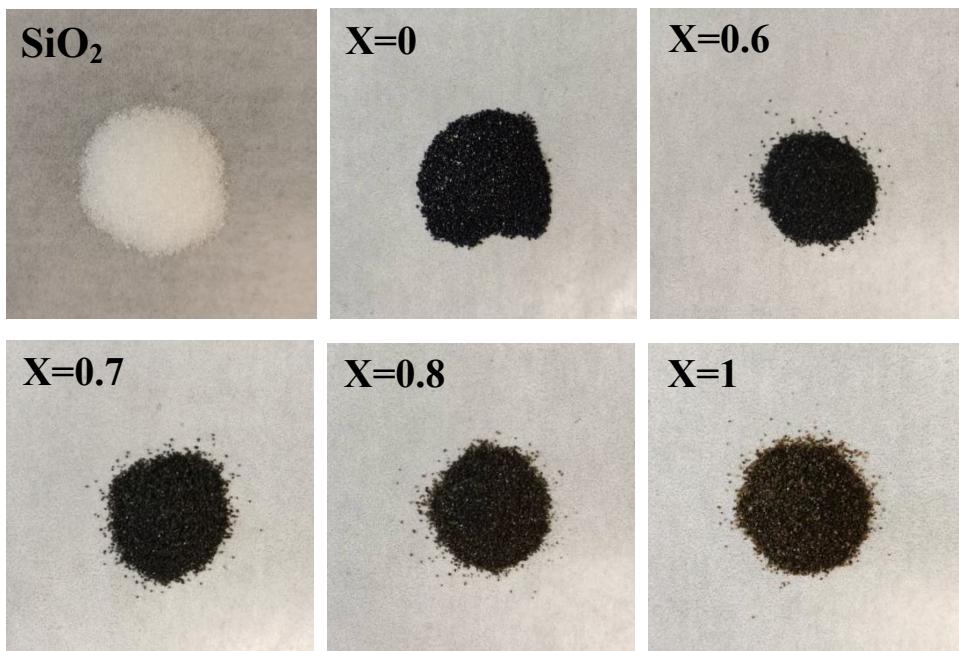


Figure S1. Optical photos of the prepared catalysts of  $\text{LaCo}_{1-x}\text{Ni}_x\text{O}_3/\text{SiO}_2$  ( $x = 0, 0.6 - 0.8, 1$ ) and  $\text{SiO}_2$ .

Table S1. Physical properties of the catalysts of  $\text{LaCo}_{1-x}\text{Ni}_x\text{O}_3/\text{SiO}_2$  ( $x = 0, 0.6 - 0.8, 1$ ) and  $\text{SiO}_2$ .

Samples	Theoretical Elemental analysis <sup>a</sup>			$S_{\text{BET}}$ ( $\text{m}^2\text{g}^{-1}$ )	$V_{\text{BJH}}$ ( $\text{cm}^3\text{g}^{-1}$ )	Pore size (nm)	$d_{\text{metal NPs}}^{\text{b}}$ (nm)	
	La (wt. %)	Ni (wt. %)	Co (wt. %)				After reduction	After reaction
	/	/	/				/	/
$\text{SiO}_2$	/	/	/	502	0.64	5.7	/	/
X=1	14.1	6.0	/	372	0.45	4.9	9.2	2.7
X=0.8	14.1	4.8	1.2	375	0.44	4.9	7.4	6.2
X=0.7	14.1	4.2	1.8	363	0.43	5.0	7.6	6.3 (5.2 <sup>c</sup> )
X=0.6	14.1	3.6	2.4	369	0.43	4.9	7.7	6.8
X=0	14.1	/	6.0	342	0.41	4.9	9.6	10.5

<sup>a</sup> Content of La, Co and Ni in the calcined catalysts.

<sup>b</sup> Crystal size of the metal NPs calculated according to  $2d\sin\theta=n\lambda$  based on XRD results.

<sup>c</sup> Crystal size of the metal NPs after stability test.

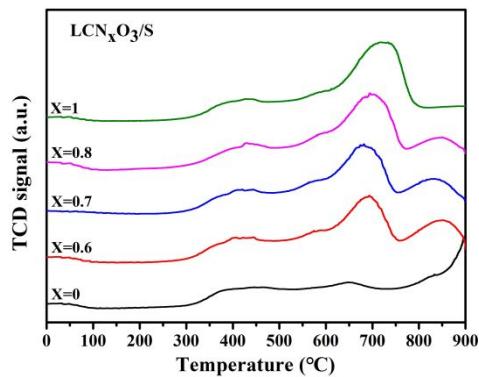


Figure S2. TPR profiles of the catalysts of  $\text{LaCo}_{1-x}\text{Ni}_x\text{O}_3/\text{SiO}_2$  ( $x = 0, 0.6 - 0.8, 1$ ).

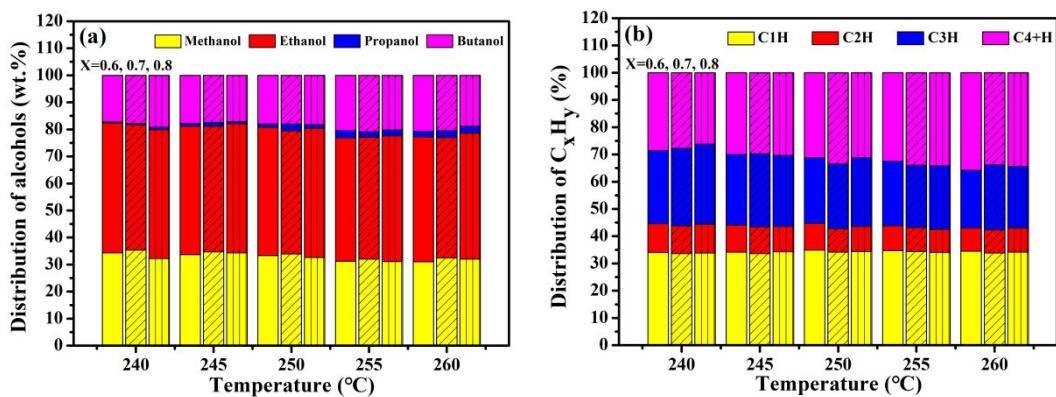


Figure S3. The distributions of alcohols (a) and hydrocarbons (b) over the catalysts of  $\text{LaCo}_{1-x}\text{Ni}_x\text{O}_3/\text{SiO}_2$  ( $x = 0.6, 0.7, 0.8$ ), (□)  $x = 0.6$ , (▨)  $x = 0.7$  and (▨)  $x = 0.8$ .