Electronic Supplementary Material

Mg-Al-hydrotalcite with alkaline sites protects Ni/KIT-6 from formation of amorphous coke in glycerol steam reforming via tailoring reaction intermediates

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Table S1 Information of the reagents used in the experiments

Entry	Chemical reagent	Molecular formula	Relative molecular mass	Purity	Brand
1	Sodium Carbonate	Na_2CO_3	105.99	Analytical grade	Sinopharm Chemical Reagent Co., Ltd.
2	Sodium hydroxide	NaOH	40.00	Analytical grade	Sinopharm Chemical Reagent Co., Ltd.
3	Magnesium nitrate hexahydrate	$Mg(NO_3)_2·6H_2O$	256.41	Analytical grade	Sinopharm Chemical Reagent Co., Ltd.
4	Aluminum nitrate nonahydrate, low mercury	$Al(NO_3)_2·9H_2O$	375.13	Analytical grade	Sinopharm Chemical Reagent Co., Ltd.
5	Nickel(II) nitrate hexahydrate	$Ni(NO_3)_2·6H_2O$	290.79	Analytical grade	Sinopharm Chemical Reagent Co., Ltd.
6	Polyethylene glycol-block-polypropylen eglycol-block -polyethylene glycol	PEO-PPO-PEO	5800	Analytical grade	Shanghai Aladdin Biochemical Technology Co., Ltd.
7	Hydrochloric	HCl (36.5%)	36.5	Analytical	Yantai Far Eastern

	acid			grade	Fine Chemical Co., Ltd.
8	1-Butanol	$CH_3(CH_2)_3OH$	74.12	Analytical grade	Sinopharm Chemical Reagent Co., Ltd.
9	Tetraethyl orthosilicate	$C_8H_{20}O_4Si$	208.33	Analytical grade	Shanghai Aladdin Biochemical Technology Co., Ltd.
10	Glycerol	$C_3H_5(OH)_3$	92.09	Analytical grade	Sinopharm Chemical Reagent Co., Ltd.

Table S2 The basic ssites of the Mg_5-Al_1-LDH catalyst

Catalyst	**Weak (μmol/g)**	**Moderate (μmol/g)**	**Strong (μmol/g)**	**Total CO_2 uptake (μmol/g)**
Mg_5-Al_1-LDH	1.5	192.9	175.8	370.2

Table S3 The acid number of the Mg_1-Al_5-LDH catalyst

Catalyst	**Weak (μmol/g)**	**Moderate (μmol/g)**	**Total NH_3 uptake (μmol/g)**
Mg_1-Al_5-LDH	2.1	11.9	14.0

Table S4 Particle size of nickel species of the catalysts[a]

Catalyst condition	**Catalysts**	**Ni particle size (nm)**	**NiO size (nm)**
After calcination	Ni/KIT-6	--	13.0
After reduction	Ni/KIT-6	17.6	--
After catalytic test	Ni/KIT-6	14.2	--
	Mg_1Al_5-LDH + Ni/KIT-6	14.4	--
	Mg_5Al_1-LDH + Ni/KIT-6	14.1	--
After short-term stability test	Ni/KIT-6	14.9	--
	Mg_1Al_5-LDH + Ni/KIT-6	14.1	--
	Mg_5Al_1-LDH + Ni/KIT-6	14.6	--

[a]Calculated from the XRD results in Figure 2 and 8 with Debye-Scherrer formula: $D = \frac{K\gamma}{B\cos\theta}$.

where K is the Scherrer constant, if B is the half-height width of the diffraction peak, then K = 0.89; if B is the integral height and width of the diffraction peak, then K = 1. D is the average thickness of the crystal grain

perpendicular to the crystal plane direction (nm), B is the half-height width of the measured sample diffraction peak; θ is the Bragg diffraction angle; γ is the x-ray wavelength, generally 0.154178 nm.

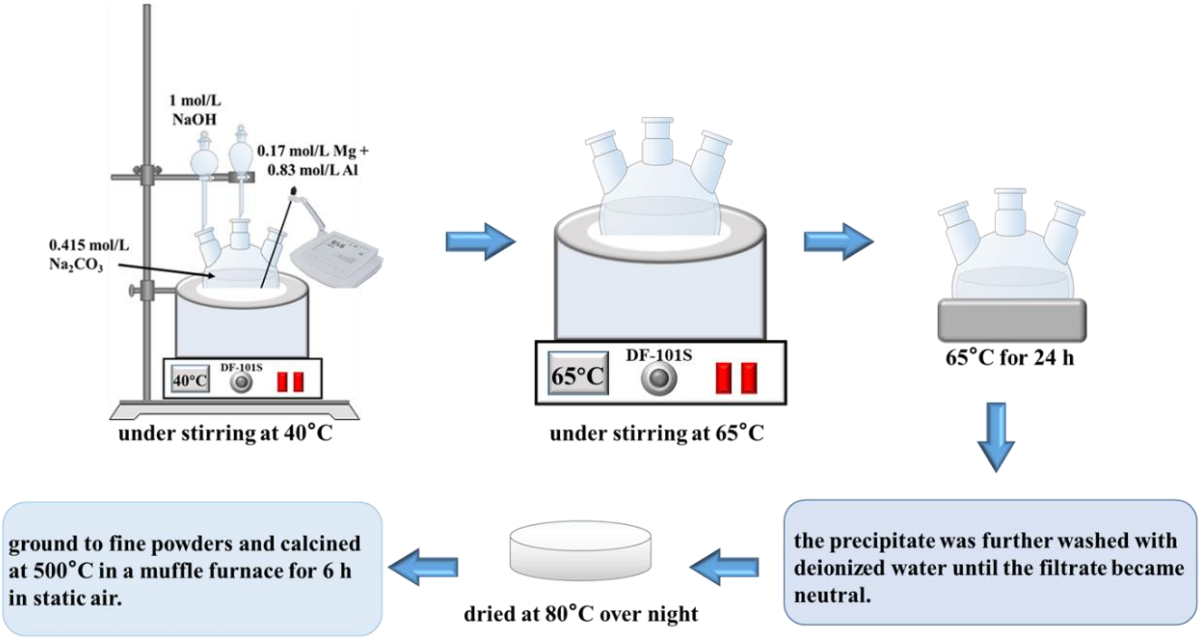

Figure S1. The preparation of Mg_1-Al_5-LDH.

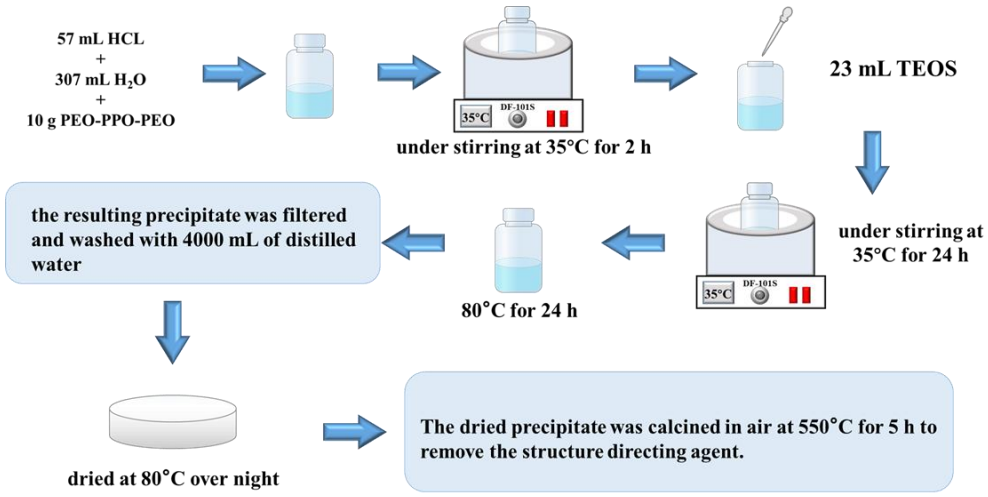

Figure S2. The preparation of KIT-6.

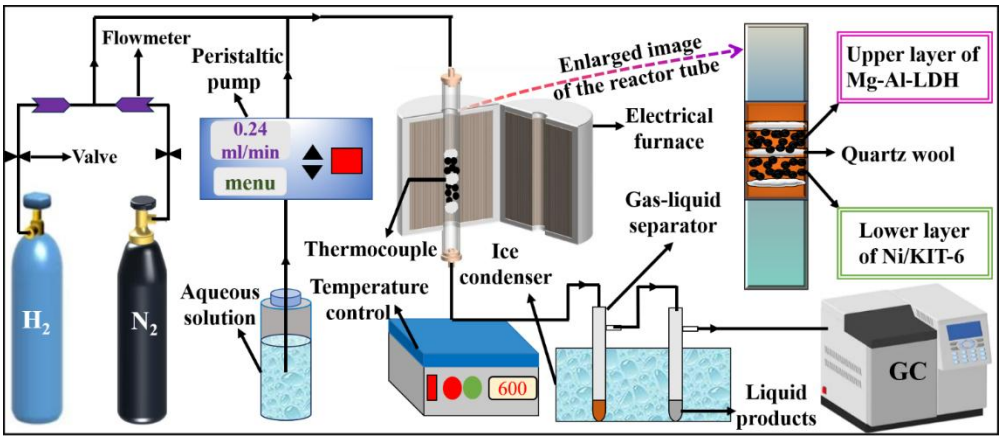

Figure S3. Schematic of the steam reforming experimental setup.

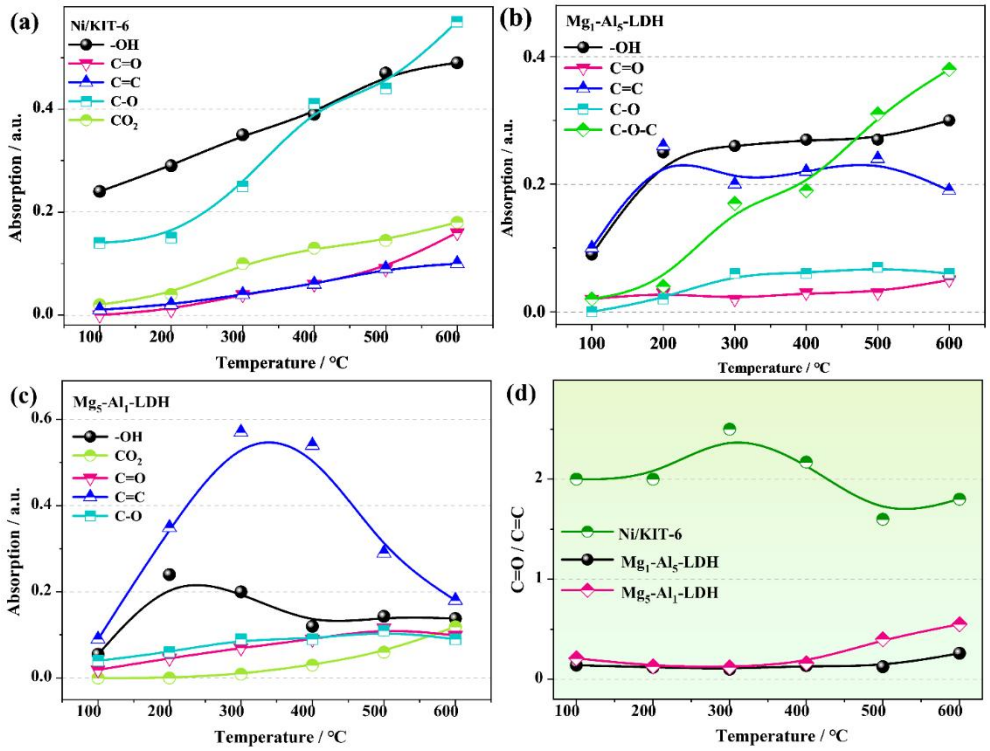

Figure S4. The abundance of the functional groups of the Ni/KIT-6 catalyst and Mg-Al-LDH derived from the in-situ DRIFTS during the steam reforming of glycerol. (a): Ni/KIT-6; (b): Mg_1-Al_5-LDH; (c): Mg_5-Al_1-LDH; (d): The value of C=O/C=C.

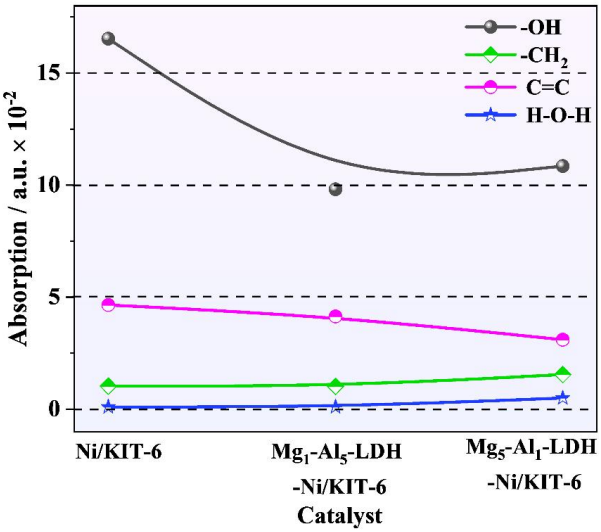

Figure S5. Peak intensity of typical functionalities of the reaction intermediates in the FT-IR characterization.

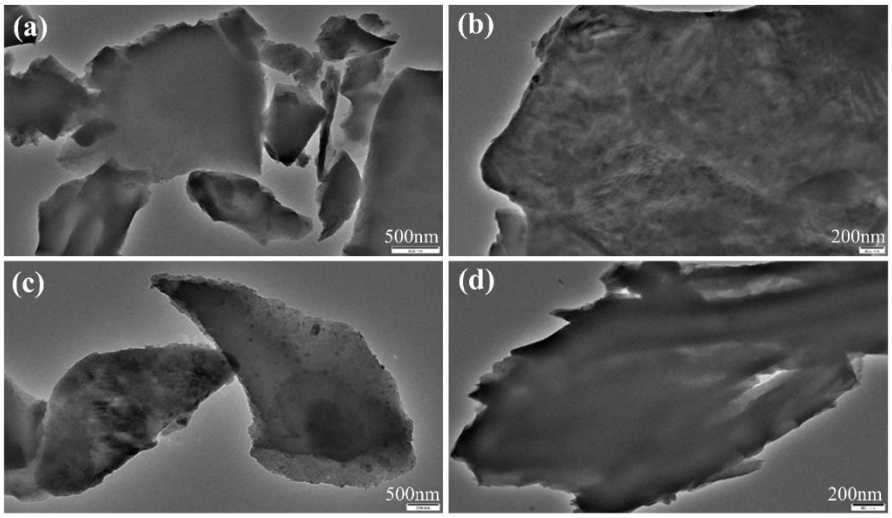

Figure S6 The TEM characterization of the spent catalysts after steam reforming of glycerol. (a) and (b): Mg_1-Al_5-LDH; (c) and (d): Mg_5-Al_1-LDH.