catalysts

MDPI

Supporting information

Effect of Mg Contents on Catalytic Activity and Coke Formation of Mesoporous Ni/Mg-aluminate Spinel Catalyst for Steam Methane Reforming

Hyunjoung Kim[1,§], Young-Hee Lee[1,§], Hongjin Lee[1], Jeong-Cheol Seo[2], Kyubock Lee[1,*]

[1] Graduate School of Energy Science and Technology, Chungnam National University, 99 Daehak-ro, Yuseong-gu, Daejeon 34134, Republic of Korea; ndieazure@o.cnu.ac.kr (H.K.); 201730154@o.cnu.ac.kr (Y.-H. L.); lhj15999@o.cnu.ac.kr (H.L.)

[2] Department of Chemical and Biomolecular Engineering, Korea Advanced Institute of Science and Technology, 291 Daehak-ro, Yuseong-gu, Daejeon 34141, Republic of Korea; sjc9201@kaist.ac.kr (J.-C.S.)

[§] These authors contributed equally to this work.

* Correspondence: kyubock.lee@cnu.ac.kr (K. L.) Tel.: +82-48-821-8610; Fax. : +82-42-821-8839

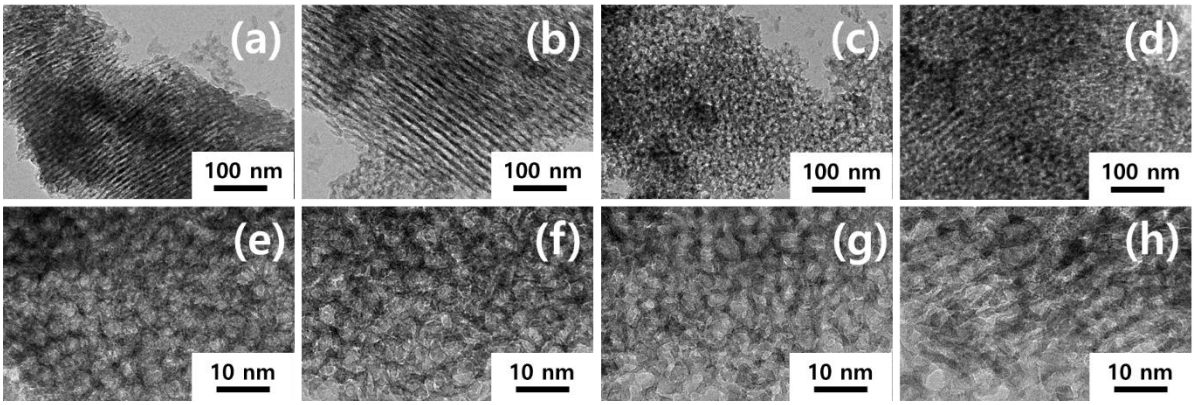

Figure S1. TEM images of mesoporous Mg-aluminate calcined at 600 °C: (a,e) Mg9, (b,f) Mg19, (c,g) Mg25, (d,h) Mg30.

Table S1. Pore structure analysis of mesoporous Mg-aluminate supports, after Ni loading with calcination and after reduction.

Sample	N_2-sorption analysis			
	BET surface area (m^2/g)	**Pore volume (cm^3/g)**	**Mean pore size (nm)**	**d_P, peak (nm)**
Commercial catalyst	11.071	0.0272	7.679	10.54
Mg9	170.05	0.5857	13.777	9.23
Mg19	141.48	0.5744	16.239	12.05
Mg25	114.02	0.6191	20.979	15.88
Mg30	92.605	0.5871	25.358	18.37
Mg9-Ni	101.27	0.2693	8.08	10.639
Mg19-Ni	74.452	0.2835	12.05	15.238
Mg25-Ni	68.544	0.255	10.54	14.881
Mg30-Ni	65.859	0.3232	13.81	19.631
Ni/Mg9	103.44	0.398	15.39	12.05
Ni/Mg19	68.976	0.3739	21.683	15.88
Ni/Mg25	66.858	0.3937	23.552	18.37
Ni/Mg30	69.63	0.3881	22.292	18.37

Table S2. JCPDS card information of main peaks.

2-theta from JCPDS Cards		Lattice Plane h k l			
		3 1 1	**4 0 0**	**5 1 1**	**4 4 0**
21-1152	$MgAl_2O_4$	36.852	44.832	59.37	65.241
10-0339	$NiAl_2O_4$	37.009	44.996	59.661	65.535
48-0528	$Mg_{0.388}Al_{2.408}O_4$	37.344	45.449	60.24	66.333

Table S3. The temperature difference between inside of the catalyst bed and outside of the reactor during the reaction.

Temp.[°C], S/C GHSV[h^{-1}]		**800, 3**			**700, 1**
		8000	**16000**	**24000**	**8000**
$T_{difference}$ [°C] = $T_{outer\ reactor}$ – $T_{in\ catalyst\ bed}$	**Commercial Catalyst**	15.4	21.4	28.7	12.4
	Ni/Mg9	14.3	20.8	30.6	12.9
	Ni/Mg19	15.6	23.3	30.5	13.2
	Ni/Mg25	15.8	23	32.2	12.5
	Ni/Mg30	15.7	23.2	31.4	12.8

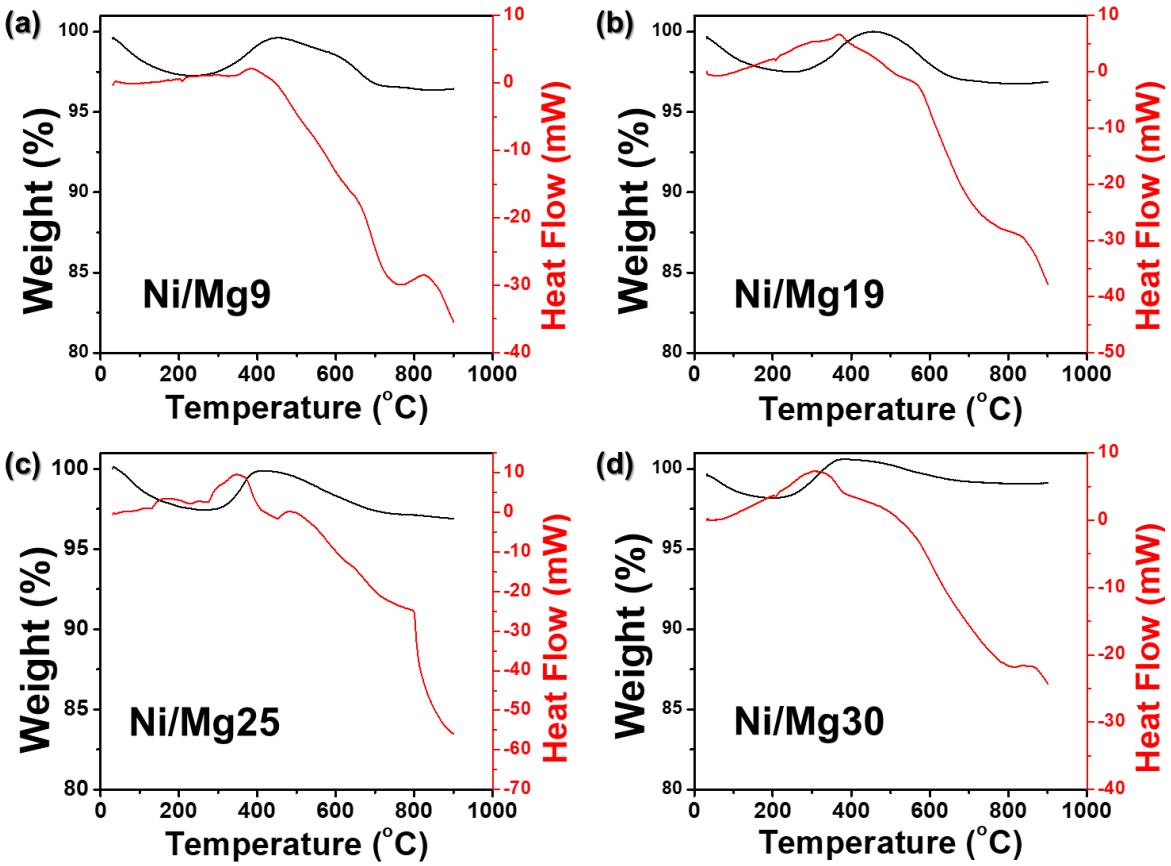

Figure S2. TGA-DSC analysis of catalysts after reaction under harsh conditions: (a) Ni/Mg9, (b) Ni/Mg19, (c) Ni/Mg25, and (d) Ni/Mg30.