Table S1. Chemical composition and preparation of the composites.

Code	Metal	Si to metal atomic ratio	Chemical form of metal	Preparation method	Reference
Al1	Al	Si/Al 95.0	Al_2O_3	Mixed in one-pot Al_2O_3	12
Al2		Si/Al 78.0			
Al3		Si/Al 54.0			
Al4		Si/Al 31.0			
Al5		Si/Al 22.0			
Al6		Si/Al 14.0			
Al7		Si/Al 56.0			
Al8		Si/Al 16.0			
Al9	Al	Si/Al 20.4		Chemical vapor deposition $AlCl_3$ hydrolysis	13
Al10		Si/Al 22.0			
Al11		Si/Al 4.2			
Al12		Si/Al 11.8			
Al13		Si/Al 13.1			
Al14		Si/Al 11.7			
Al15	Al	Si/Al 5.0		One-pot method $Al_2(SO_4)_3$	14
Al16		Si/Al 10.0			
Al17		Si/Al 20.0			
Al18	Al	Si/Al 10.1		Hydrothermal	15
Al19		Si/Al 5.4		active γ-Al_2O_3 ground to 1 mm with a ball grinder	15
Al20		Si/Al 2.9			15
Al21	Al	Si/Al 20.0		Sodium-aluminate	16
Al/Ti1	Al Ti	Si/Al 8.4 Si/Ti 16.8		Chemical vapor deposition $AlCl_3$ $TiCl_4$ hydrolysis	13
Al/Ti2		Si/Al 8.0 Si/Ti 14.6			

Ca1	Ca	Si/Ca 8.7		Wetness impregnation $Ca(NO_3)_2$	17
Ca2	Ca	Si/Ca 10.0		One-pot route $Ca(NO_3)_2$	18
Ca3		Si/Ca 5.0			
Ca4		Si/Ca 3.3			
Ca5		Si/Ca 2.5			
Ca6		Si/Ca 2.0			
Ca7		Si/Ca 2.5		Wetness impregnation $Ca(NO_3)_2$	
Cd1	Cd	Si/Cd 467.8	CdO	Chemical vapor deposition Cd (metal)	19
Cd2		Si/Cd 17.2			
Cd3		Si/Cd 28.3			
Cd4		Si/Cd 143.9			
Cd5		Si/Cd 46.8			
Cd6		Si/Cd 1871.0			
Cd7		Si/Cd 38.2			
Cd8		Si/Cd 42.5			
Cd9		Si/Cd 26.4			
Cd10		Si/Cd 27.9			
Cd11		Si/Cd 53.5			
Ce1	Ce	Si/Ce 32.2	CeO_2	Hydrothermal $Ce(NO_3)_3$	20
Ce2	Ce	Si/Ce 21.0	CeO_2	Wetness impregnation $Ce(NO_3)_2$	21
Ce3	Ce	Si/Ce 8.6	CeO_2	$Ce(NO_3)_3$	22
Ce4		Si/Ce 16.2			
Ce5		Si/Ce 32.9			

Ce6	Ce	Si/Ce 36.5	CeO_2	Wetness impregnation $Ce(NO_3)_3$	23
Ce7	Ce	Si/Ce 52.6		Hydrothermal $Ce(NO_3)_3$	24
Ce8		Si/Ce 26.3			
Ce9		Si/Ce 18.2			
Ce10		Si/Ce 13.2			
Ce11	Ce	Si/Ce 1000	-	Colloidal acidic suspension of CeO_2 nanoparticles (10% in water)	25
Ce12		Si/Ce 100	CeO_2		
Ce13		Si/Ce 33.3			
Ce14		Si/Ce 12.5			
Ce15	Ce	Si/Ce 31.0	CeO_2	Wetness impregnation $Ce(NO_3)_3$	26
Ce/Ni8	Ni Ce	Si/Ce 100 Si/Ni 18.6	CeO_2 Ni	Colloidal acidic suspension of CeO_2 nanoparticles (10% in water) Wetness impregnation $Ni(NO_3)_2$	25
Ce/Ni9		Si/Ce 33.3 Si/Ni 18.6			
Ce/Ni10		Si/Ce 12.5 Si/Ni 18.6			
Ce/Ni11	Ce Ni	Si/Ce 117.0 Si/Ni 33.2	Ni	surfactant-assisted iso-volumetric impregnation method $Ni(NO)_3$ $Ce(NO_3)_3$ cetyltrimethylammonium bromide (CTAB)	27
Ce/Ni12		Si/Ce 62.5 Si/Ni 33.9			
Ce/Ni13		Si/Ce 29.6 Si/Ni 31.4	CeO_2		
Ce/Ni14		Si/Ce 14.0 Si/Ni 30.2			
Ce/Zr1	Ce Zr	Si/Ce 124.8 Si/Zr 77.0	CeO_2	Wetness impregnation	26

Ce/Zr2		Si/Ce 81.7 Si/Zr 157.1		$ZrO(NO_3)_2$ $Ce(NO_3)_3$	
Co1	Ce	Si/Co 4.0	Co_3O_4	Wetness impregnation $Ce(NO_3)_3$	20
Co2	Co	–	Co_3O_4	Wetness impregnation $Co(NO_3)_2$	28
Co3		–			
Co4		–			
Co5	Co	Si/Co 45.7	Co_3O_4	$Co(NO_3)_2$	29
Co6		Si/Co 26.3			
Co7		Si/Co 17.9			
Co8		Si/Co 26.3			
Co9		Si/Co 17.9			
Co10	Co	Si/Co 18.6	Co_3O_4	Wetness impregnation $CoCl_2$	30
Co11		Si/Co 18.6		Wetness impregnation $Co(CH_3COO)_2$	
Co12		Si/Co 18.6	Co_3O_4 Co_2O_3 CoO	Wetness impregnation $Co(NO_3)_2$	
Co13	Co	Si/Co 13.4	Co_3O_4	$Co(NO_3)_2$	31
Co14	Co	Si/Co 7.2	Co_3O_4	Wetness impregnation $Co(NO_3)_2$	32
Co15	Co	Si/Co 9.1		Wetness impregnation $Co(NO_3)_2$	33

Co16	Co	Si/Co 7.2	Co_3O_4	Wetness impregnation $Co(NO_3)_2$	34
Co17	Co	Si/Co 8.8	Cobalt silicate hydroxide	Deposition-precipitation $Co(NO_3)_3$ urea	35
Co18	Co	Si/Co 8.8	Co_3O_4	Wetness impregnation $Co(NO_3)_2$	36
Co/Al1	Co Al	Si/Co 5.0 Si/Al 4.5		Hydrothermal active γ-Al_2O_3 ground to 1 mm with a ball grinder wetness impregnation $Co(NO_3)_2$	15
Co/Ca1	Co Ca	Si/Co 12.5 Si/Ca 9.0	Co_3O_4	Wetness impregnation $Co(NO_3)_2$ $Ca(NO_3)_2$	31
Co/Ce1	Co Ce	Si/Co 4.0 Si/Ce 32.2	CeO_2 Co_3O_4	hydrothermal $Ce(NO_3)_3$ Wetness impregnation $Co(NO_3)_2$	20
Co/Ce2	Co Ce	Si/Ce 6.3 Si/Co 2.7	CeO_2 Co_3O_4	Wetness impregnation $Ce(NO_3)_3$ $Co(NO_3)_2$	22
Co/Ce3		Si/Ce 12.4 Si/Co 3.2			
Co/Ce4		Si/Ce 25.8 Si/Co 3.5			
Co/Ce5		Si/Ce 25.8			

		Si/Co 3.5			
Co/Ce6		Si/Ce 27.6 Si/Co 5.0			
Co/Ce7		Si/Ce 29.4 Si/Co 8.0			
Co/Mg 1	Co Mg	Si/Co 13.1 Si/Mg 6.9	Co_3O_4	Wetness impregnation $Co(NO_3)_2$ $Mg(NO_3)_2$	31
Co/Mo 1	Co Mo	Si/Co 76.9 Si/Mo 36.9	β-$CoMoO_4$	Wetness impregnation $(NH_4)_6Mo_7O_{24}$ $Co(NO_3)_2$	37
Co/Mo 2		Si/Co 35.3 Si/Mo 17.0			
Co/Mo 3		Si/Co 21.5 Si/Mo 10.3			
Co/Mo 4		Si/Co 76.9 Si/Mo 36.9		Wetness impregnation $(NH_4)_6Mo_7O_{24}$ $Co(NO_3)_2$ EDTA	
Co/Mo 5		Si/Co 35.3 Si/Mo 17.0			
Co/Mo 6		Si/Co 21.5 Si/Mo 10.3			
Co/Mo 7		Si/Co 76.9 Si/Mo 36.9		Wetness impregnation $(NH_4)_6Mo_7O_{24}$ $Co(NO_3)_2$ citric acid	
Co/Mo 8		Si/Co 35.3 Si/Mo 17.0			
Co/Mo 9		Si/Co 21.5 Si/Mo 10.3			
Co/Ni1	Co Ni	Si/Co 17.7 Si/Ni 17.6	NiO $CoCo_2O_4$ $NiCo_2O_4$	Wetness impregnation $Co(NO_3)_2$ $Ni(NO_3)_2$	38

Co/Ni2	Co Ni Mg	Si/Co 16.7 Si/Ni 16.6 Si/Mg 6.9		Wetness impregnation $Co(NO_3)_2$ $Ni(NO_3)_2$ $Mg(NO_3)_2$	
Co/Ni3	Co Ni La	Si/Co 16.7 Si/Ni 16.6 Si/La 39.3		Wetness impregnation $Co(NO_3)_2$ $Ni(NO_3)_2$ $La(NO_3)_3$	
Co/Ni4	Co Ni Sc	Si/Co 16.7 Si/Ni 16.6 Si/Sc 12.7	NiO $CoCo_2O_4$ $NiCo_2O_4$	Wetness impregnation $Co(NO_3)_2$ $Ni(NO_3)_2$ $Sc(NO_3)_3$	
Co/Ru1	Co Ru	Si/Co 7.1 Si/Ru 195.7	Co_3O_4 RuO_2	Wetness impregnation $Co(NO_3)_2$ $Ru(NO)(NO_3)_3$	32
Co/Ru2		Si/Co 7.1 Si/Ru 129.9			
Co/Ru3		Si/Co 7.1 Si/Ru 97.0	Co_3O_4 RuO_2		
Cr1	Cr	Si/Cr 15.8		$Cr(NO_3)_3$	29
Cu1	Cu	Si/Cu 16.6	CuO After reaction Cu_2O Cu	Wetness impregnation $Cu(NO_3)_2$	23
Cu2	Cu	Si/Cu 25.2	CuO	Wetness impregnation $Cu(NO_3)_2$	39
Cu3		Si/Cu 11.1	CuO Cu_2O		
Cu4		Si/Cu 9.4			
Cu5	Cu	Si/Cu 19.3		$Cu(NO_3)_2$	29

Cu/Al1	Cu Al	-		One-pot method precipitation condensation $Al_2(SO_4)_3$ $CuSO_4$ ammonia sodium citrate	14
Cu/Ce1	Cu Ce	Si/Cu 24.8 Si/Ce 109.6	CuO CeO_2	Wetness impregnation $Cu(NO_3)_2$ $Ce(NO_3)_3$	23
Cu/Ce2		Si/Cu 33.1 Si/Ce 73.1			
Cu/Ce3		Si/Cu 49.7 Si/Ce 54.8			
Cu/Ce4	Cu Ce	Si/Cu 60.2 Si/Ce 28.7	CeO_2 No evidence of Cu compounds	Wetness impregnation $Ce(NO_3)_3$ $Cu(NO_3)_2$	26
Cu/Ce5	Cu Ce Zr	Si/Cu 66.7 Si/Ce 81.7 Si/Zr 119.7			
Cu/Ce6		Si/Cu 70.3 Si/Ce 44.3 Si/Zr 201.7			
Cu/Ni1	Cu Ni	Si/Cu 19.4 Si/Ni 83.3	NiO CuO	Incipient wetness impregnation followed by mild drying $Cu(NO_3)_2$ $Ni(NO_3)_2$	40
Cu/Ni2		Si/Cu 23.3 Si/Ni 102.9			
Cu/Ni3		Si/Cu 22.2 Si/Ni 102.7		Precipitation with Na_2CO_3 $Cu(NO_3)_2$ $Ni(NO_3)_2$	

Cu/Ni4		Si/Cu 20.3 Si/Ni 83.5		Precipitation with urea $Cu(NO_3)_2$ $Ni(NO_3)_2$	
Cu/Zn1	Cu Zn Al	-		One-pot method precipitation condensation $Al_2(SO_4)_3$ $CuSO_4$ zinc acetate ammonia sodium citrate	14
Cu/Zr1	Cu Zr	Si/Cu 63.5 Si/Zr 60.7		Wetness impregnation $ZrO(NO_3)_2$ $Cu(NO_3)_2$	26
Fe1	Fe	Si/Fe 6.7	Fe_3O_4	Wetness impregnation $Fe(NO_3)_3$ methanol	41
Fe2		Si/Fe 6.7			
Fe3		Si/Fe 6.7			
Fe4		Si/Fe 6.7		hydrothermal $Fe(NO_3)_3$	
Fe5	Fe	Si/Fe 16.9		$Fe(NO_3)_3$	29
Fe/Al1	Fe Al	Si/Fe 4.8 Si/Al 4.5		Hydrothermal active γ-Al_2O_3 ground to 1 mm with a ball grinder wetness impregnation $Fe(NO_3)_3$	15
Ga1	Ga	Si/Ga 20.0	Ga_2O_3	$Ga(NO_3)_3$	16

K/Mo1	K Mo			Wetness impregnation K_2CO_3 $(NH_4)_6Mo_7O_{24}$	42
K/Mo2					
K/Mo3			K_2MoO_4		
K/Mo4					
La/Ni1	La Ni	Si/La 6.5 Si/Ni 6.5	$LaNiO_3$	$La(NO_3)_3$ $Ni(NO_3)_2$ ethanol citric acid	43
La/Ni2	La Ca Ni	Si/La 8.5 Si/Ni 6.8 Si/Ca 34.0	$LaNiO_3$ La_2O_3 NiO Perovskite-type oxide	$La(NO_3)_3$ $Ni(NO_3)_2$ $Ca(NO_3)_2$ ethanol citric acid	
La/Ni3	La Ca Ni Co	Si/La 6.9 Si/Ni 5.6 Si/Ca 27.8 Si/Co 5.6		$La(NO_3)_3$ $Ca(NO_3)_2$ $Ni(NO_3)_2$ $Co(NO_3)_2$ ethanol citric acid	
La/Ni4	La Ni	Si/La 34.0 Si/Ni 34.0	$LaNiO_3$ perovskite	Wetness impregnation $La(NO_3)_3$ $Ni(NO_3)_2$ citric acid	44
Mg1	Mg	Si/Mg 6.3		Wetness impregnation $Mg(NO_3)_2$	17
Mn1	Mn	Si/Mn 16.7		$MnCl_2$	29
Ni1	Ni	Si/Ni 13.3	NiO	Wetness impregnation $Ni(NO_3)_2$ polyethylenimine	45

Ni2	Ni	Si/Ni 10.2	NiO	Wetness impregnation $Ni(NO_3)_2$	46
Ni3		Si/Ni 9.2		Mixed suspension with urea $Ni(NO_3)_2$	
Ni4		Si/Ni 11.2		Mixed suspension with urea and ascorbic acid $Ni(NO_3)_2$	
Ni5	Ni	Si/Ni 19.4		Wetness impregnation $Ni(NO_3)_2$	47
Ni6	Ni	Si/Ni 17.9		$Ni(NO_3)_2$	29
Ni7	Ni	Si/Ni 7.2	NiO Ni	Wetness impregnation $Ni(NO_3)_2$	24
Ni8	Ni	Si/Ni 8.8	NiO	Solvent impregnation $Ni(NO_3)_2$	48
Ni9	Ni	Si/Ni 13.4	NiO	Wetness impregnation $Ni(NO_3)_2$	17, 31
Ni10	Ni	Si/Ni 18.6	NiO	Wetness impregnation $Ni(NO_3)_2$	49
Ni11		Si/Ni 8.8			
Ni12		Si/Ni 5.5			
Ni13		Si/Ni 3.9			
Ni14		Si/Ni 2.9			
Ni15	Ni	Si/Ni 18.6	NiO	Wetness impregnation $Ni(NO_3)_2$	50
Ni16		Si/Ni 18.6			
Ni17		Si/Ni 18.6			
Ni18	Ni	Si/Ni 8.8	NiO	Wetness impregnation	51

				$Ni(NO_3)_2$	
Ni19	Ni	Si/Ni 9.2		Wetness impregnation $Ni(NO_3)_2$	33
Ni20	Ni	Si/Ni 56.7	NiO	Wetness impregnation $Ni(NO_3)_2$ pH adjusting method NaOH	52
Ni21		Si/Ni 17.2			
Ni22		Si/Ni 10.7			
Ni23		Si/Ni 9.0			
Ni24	Ni	Si/Ni 18.6	Ni	Wetness impregnation $Ni(NO_3)_2$	25
Ni25	Ni	Si/Ni 7.3	NiO	Wetness impregnation $Ni(NO_3)_2$	53
Ni29	Ni	Si/Ni 19.5	NiO	Wetness impregnation $Ni(NO_3)_2$	54
Ni30		Si/Ni 19.3			
Ni31		Si/Ni 22.2			
Ni32		Si/Ni 20.4			
Ni33		Si/Ni 21.6			
Ni34		Si/Ni 22.2			
Ni35	Ni	Si/Ni 16.9	NiO	$Ni(NO_3)_2$ *α-cyclodextrin*	55
Ni36		Si/Ni 19.5		$Ni(NO_3)_2$ *γ-cyclodextrin*	
Ni37	Ni	Si/Ni 12.1	NiO	Wetness impregnation $Ni(NO_3)_2$ ethylenediamine	56

Ni38	Ni	Si/Ni 12.1	NiO	Wetness impregnation $Ni(NO_3)_2$ citric acid	
Ni39		Si/Ni 12.1		Wetness impregnation $Ni(NO_3)_2$ acetic acid	
Ni40		Si/Ni 12.1		Wetness impregnation $Ni(NO_3)_2$	
Ni41	Ni	Si/Ni 89.0	NiO	Wetness impregnation $Ni(NO_3)_2$	57
Ni42		Si/Ni 30.2			
Ni43		Si/Ni 18.3			
Ni44		Si/Ni 9.0			
Ni45		Si/Ni 3.9			
Ni46		Si/Ni 100.1		Wetness impregnation $Ni(NO_3)_2$ EDTA	
Ni47		Si/Ni 31.2			
Ni48		Si/Ni 19.4			
Ni49		Si/Ni 9.1			
Ni50		Si/Ni 3.9	NiO		
Ni51	Ni	Si/Ni 19.5	NiO Ni	Wetness impregnation $Ni(NO_3)_2$	58
Ni52		Si/Ni 19.5		Wetness impregnation $Ni(NO_3)_2$ Poly(N-vinyl-2-pyrrolidone) (PVP)	
Ni53		Si/Ni 19.5			
Ni54		Si/Ni 19.5			
Ni55		Si/Ni 19.5			
Ni56		Si/Ni 19.5			
Ni57	Ni	Si/Ni 31.7	NiO		59

Ni58		Si/Ni 20.8		Wetness impregnation nickel citrate	
Ni59		Si/Ni 15.4			
Ni60		Si/Ni 12.1			
Ni61		Si/Ni 9.9			
Ni62	Ni	Si/Ni 33.9	Ni	surfactant-assisted iso-volumetric impregnation method $Ni(NO)_3$ cetyltrimethylammonium bromide (CTAB)	27
Ni63	Ni	Si/Ni 15.7	NiO	Incipient wetness $Ni(NO_3)_2$	60
Ni64		Si/Ni 17.8		Solid-state grinding $Ni(NO_3)_2$	
Ni65	Ni	Si/Ni 8.8	Nickel silicate hydroxide	Deposition-precipitation $Ni(NO_3)_2$ urea	35
Ni66	Ni	Si/Ni 18.6	Ni	Wet impregnation $Ni(NO_3)_2$	61
Ni/Al1	Ni Al	Si/Ni 5.0 Si/Al 4.5	NiO	Hydrothermal active γ-Al_2O_3 ground to 1 mm with a ball grinder wetness impregnation $Ni(NO_3)_2$	15
Ni/Ca1	Ni Ca	Si/Ni 13.1 Si/Ca 8.9	NiO	Wetness impregnation $Ni(NO_3)_2$ $Ca(NO_3)_2$	17, 31
Ni/Ce1	Ni	Si/Ni 7.2	NiO	Hydrothermal	24

	Ce	Si/Ce 52.6	Ni	$Ce(NO_3)_3$	
Ni/Ce2		Si/Ce 26.3 Si/Ni 7.2		Wetness impregnation $Ni(NO_3)_2$	
Ni/Ce3		Si/Ce 18.2 Si/Ni 7.2			
Ni/Ce4		Si/Ce 13.2 Si/Ni 7.2			
Ni/Ce5	Ni Ce	Si/Ni 17.4 Si/Ce 34.6		Solvent impregnation $Ni(NO_3)_2$ $Ce(NO_3)_2$	62
Ni/Ce6		Si/Ni 17.4 Si/Ce 34.6		Solvent impregnation $Ni(NO_3)_2$ $Ce(NO_3)_2$	
Ni/Ce7	Ni Ce	Si/Ce 1000.0 Si/Ni 18.6	Ni	Colloidal acidic suspension of CeO_2 nanoparticles (10% in water) Wetness impregnation $Ni(NO_3)_2$	25
Ni/Ce8	Ni Ce	Si/Ni 7.1 Si/Ce 73.6	NiO CeO_2	Wetness impregnation $Ni(NO_3)_2$ $Ce(NO_3)_3$	53
Ni/Ce10	Ni Ce Zr	Si/Ni 7.0 Si/Ce 136.4 Si/Zr 102.9	NiO	Wetness impregnation $Ni(NO_3)_2$ $Ce(NO_3)_3$ $Zr(NO_3)_4$	
Ni/Ce11	Ni Ce	Si/Ni 17.4 Ce/Si 34.6	NiO CeO_2	wet impregnation $Ni(NO_3)_2$	63

				$Ce(NO_3)_2$	
Ni/Ce12		Si/Ni 17.4 Ce/Si 34.6		ultrasonic-assisted impregnation $Ni(NO_3)_2$ $Ce(NO_3)_2$	
Ni/Ce13		Si/Ni 17.4 Ce/Si 34.6		reflux followed with impregnation $Ni(NO_3)_2$ $Ce(NO_3)_2$	
Ni/Co1	Ni Co	Si/Ni 9.9 Si/Co 80.3		Wetness co-impregnation $Ni(NO_3)_2$ $Co(NO_3)_2$	33
Ni/Co2		Si/Ni 11.5 Si/Co 44.3			
Ni/Co3		Si/Ni 16.1 Si/Co 22.8			
Ni/Co4		Si/Ni 19.2 Si/Co 18.5			
Ni/Co5		Si/Ni 31.4 Si/Co 12.4			
Ni/Co6	Ni Co Al	Si/Co 25.3 Si/Ni 6.3 Si/Al 4.5		Hydrothermal active γ-Al_2O_3 ground to 1 mm with a ball grinder wetness impregnation $Co(NO_3)_2$ $Ni(NO_3)_2$	15
Ni/Co7	Ni Co	Si/Ni 17.6 Si/Co 17.6	Nickel silicate hydroxide Cobalt silicate hydroxide	Deposition-precipitation $Ni(NO_3)_2$ $Co(NO_3)_3$ urea	35

Ni/Fe1	Fe Ni Al	Si/Fe 24.0 Si/Ni 6.3 Si/Al 4.5		Hydrothermal active γ-Al_2O_3 ground to 1 mm with a ball grinder wetness impregnation $Fe(NO_3)_3$ $Ni(NO_3)_2$	15
Ni/Mg1 Ni/Mg2 Ni/Mg3 Ni/Mg4 Ni/Mg5	Ni Mg Al	-	NiO-MgO Ni After reaction Ni NiO-MgO Mg_2SiO_4 $MgAl_2O_4$	$Ni(NO_3)_2$ $Mg_6Al_2(CO_3)(OH)_{16}$ (hydrotalcite)	64
Ni/Mg6	Ni Mg	Si/Ni 12.8 Si/Mg 5.8	NiO	Wetness impregnation $Ni(NO_3)_2$ $Mg(NO_3)_2$	17, 31
Ni/Sm1	Ni Sm	Si/Ni 8.7 Si/Sm 448.0	NiO	Wetness impregnation $Ni(NO_3)_2$ $Sm(NO_3)_3$	51
Ni/Sm2		Si/Ni 8.7 Si/Sm 147.6	NiO Sm_2O_3		
Ni/Sm3		Si/Ni 8.5 Si/Sm 72.6			
Ni/Sn1	Ni Sn Al	Si/Sn 50.9 Si/Ni 6.3 Si/Al 4.5	Ni_3Sn_2 (alloy)	Hydrothermal active γ-Al_2O_3 ground to 1 mm with a ball grinder wetness impregnation $SnCl_2$	15

				$Ni(NO_3)_2$	
Ni/W1	Ni W	Si/Ni 8.8 Si/W 2.8		Wet impregnation $Ni(NO_3)_2$ $(NH_4)_6H_2W_{12}O_{40}$	61
Ni/W2	Ni W Zr	Si/Ni 11.2 Si/W 17.6 Si/Zr 3.2	WO_2 Ni_4W (alloy) W	Hydrothermal $ZrO(NO_3)_2$ Wet impregnation $Ni(NO_3)_2$ $(NH_4)_6H_2W_{12}O_{40}$	
Ni/W3		Si/Ni 7.3 Si/W 3.8 Si/Zr 2.1			
Ni/W4		Si/Ni 3.4 Si/W 1.1 Si/Zr 1.0			
Ni/Y1	Ni Y	Si/Y 55.5 Si/Ni 8.5	NiO	Solvent impregnation $Ni(NO_3)_2$ $Y(NO_3)_3$	48
Ni/Zr1	Ni Zr	Si/Ni 8.5 Si/Zr 59.5	NiO	Solvent impregnation $Ni(NO_3)_2$ $Zr(NO_3)_4$	
Ni/Zr2	Ni Zr	Si/Ni 7.2 Si/Ce 81.4	NiO ZrO_2	Wetness impregnation $Ni(NO_3)_2$ $Zr(NO_3)_4$	53
Ni/Zr3	Ni Zr	Si/Ni 13.2 Si/Zr 3.7	Ni	Hydrothermal $ZrO(NO_3)_2$ Wet impregnation $Ni(NO_3)_2$	61
Sm/Co1	Sm Co	Si/Sm 519.5 Si/Co 8.8	Co_3O_4	Wetness impregnation	36

Sm/Co2		Si/Sm 258.3 Si/Co 8.7		$Co(NO_3)_2$ $Sm(NO_3)_3$	
Sm/Co3		Si/Sm 171.2 Si/Co 8.7			
Sm/Ni1	Sm Ni	Si/Sm 519.5 Si/Ni 8.7	NiO	Wetness impregnation $Ni(NO_3)_2$ $Sm(NO_3)_3$	36
Sm/Ni2		Si/Sm 258.3 Si/Ni 8.7			
Sm/Ni3		Si/Sm 171.2 Si/Ni 8.6			
Sm/Ni4	Sm Ni	Si/Sm 84.2 Si/Ni 8.5	NiO	Solvent impregnation $Ni(NO_3)_2$ $Sm(NO_3)_3$	48
Sn/Al1	Sn Al	Si/Sn 10.2 Si/Al 4.5	SnO	Hydrothermal active γ-Al_2O_3 ground to 1 mm with a ball grinder wetness impregnation $SnCl_2$	15
Ti1	Ti	Si/Ti 5.1	No crystalline Ti compounds	chemical vapor deposition $TiCl_4$ hydrolysis	13
Ti2		Si/Ti 22.7			
Ti3		Si/Ti 2.8			
Ti4		Si/Ti 9.1			
Ti5		Si/Ti 26.2			
Ti6		Si/Ti 1.7			
Ti7		Si/Ti 1.7			
Ti8		Si/Ti 3.7			
Ti9		Si/Ti 3.3			
Ti10		Si/Ti 2.9			

Ti11		Si/Ti 2.9			
Ti12		Si/Ti 2.0			
Ti13		Si/Ti 1.8			
Ti/Al1	Ti Al	Si/Ti 15.5 Si/Al 47.1	No crystalline Ti or Al compounds	chemical vapor deposition $TiCl_4$ $AlCl_3$ hydrolysis	
Ti/Al2		Si/Ti 19.5 Si/Al 77.1			
Ti/Al3		Si/Ti 6.3 Si/Al 77.1			
Ti/Al4		Si/Ti 6.3 Si/Al 121.2			
V1	V	Si/V 22.7	VO_x	Wet impregnation Vanadium oxo-complexes	65
V2		Si/V 8.6			
V3	V	Si/V 12.0	V_2O_5	Wetness impregnation NH_4NO_3	66
V4		Si/V 10.6	V_2O_5		
V5		Si/V 8.7	V_2O_5		
V6		Si/V 7.5	V_2O_5		
V7		Si/V 6.9	V_2O_5		
Zn1	Zn	Si/Zr 19.8		$Zn(NO_3)_3$	29
Zn2	Zn	Si/Zn 10882.2	ZnO	chemical vapor deposition Zn (metal)	19
Zn3		Si/Zn 518.2			
Zn4		Si/Zn 236.6			
Zn5		Si/Zn 28.3			
Zn6		Si/Zn 24.8			
Zn7		Si/Zn 63.3			
Zn8		Si/Zn 19.4			
Zn9		Si/Zn 15.8			
Zn10		Si/Zn 15.8			
Zn11		Si/Zn 26.7			

Zn12		Si/Zn 39.4			
Zn/Al1	Zn Al			One-pot method precipitation condensation $Al_2(SO_4)_3$ zinc acetate ammonia sodium citrate	14
Zr1	Zr	Si/Zr 11.1	Zirconium phosphate	Zirconium(IV) n-propoxide	67
Zr2	Zr	Si/Zr 40.7		Wetness impregnation $ZrO(NO_3)_2$	26
Zr3	Zr	Zr/Si 4.0		Hydrothermal $ZrO(NO_3)_2$	61
Zr/Ce1	Zr Ce Ni	Si/Zr 5.0 Si/Ce 3.3 Si/Ni 8.8	$Ce_{0.75}Zr_{0.25}O_2$ NiO	Wetness impregnation $ZrO(NO_3)_2$ $Ce(NO_3)_3$ $Ni(NO_3)_2$	68
Zr/Ce2		Si/Zr 5.0 Si/Ce 3.3 Si/Ni 8.8	NiO		
Zr/Ce3		Si/Zr 5.0 Si/Ce 3.3 Si/Ni 8.8		Wetness impregation $ZrO(NO_3)_2$ $Ce(NO_3)_3$ $Ni(NO_3)_2$ ammonia	
Zr/P1	Zr P	Si/Zr 11.5 Si/P 6.2	Zirconium phosphate	Zirconium(IV) n-propoxide $POCl_3$	67
Zr/P2		Si/Zr 5.2 Si/P 3.1			
Zr/P3		Si/Zr 9.2		One-pot grafting	

		Si/P 4.3		Zirconium(IV) n-propoxide $POCl_3$	
Zr/P4		Si/Zr 7.2 Si/P 3.4			

Table S2. Characterization of SBA-15 and of SBA-15-metal composites. SSA in m^2/g.

Metal/Code	SSA original SBA-15	SSA composite	XRD, structure, size of crystallites	Other methods	Reference
Al1		656	No crystalline Al compounds	TEM ^{29}Si MAS-NMR NH_3-TPD FTIR	12
Al2		766			
Al3		816			
Al4		826			
Al5		792			
Al6		1103			
Al7		904			
Al8		873			
Al9	910	881	No crystalline Al compounds	TEM ζ potential	13
Al10		884			
Al11		889			
Al12		878			
Al13		915			
Al14		864			
Al15		623	No crystalline Al compounds	HRTEM TG DTG FTIR	14
Al16		830			
Al17		890			
Al18	934	449			15

Al19		538	No crystalline Al compounds		
Al20		536			
Al21	1050	920	No crystalline Al compounds	^{27}Al-MAS-NMR TEM	16
Al/Ti1	910	826		TEM	13
Al/Ti2		807		ζ potential	
Ca1	581	333		TEM H_2-TPR TGA	17
Ca2	536	408		CO_2-TPR	18
Ca3		342		TEM	
Ca4		282		TGA	
Ca5		172		DTG	
Ca6		152		DSC	
Ca7		169			
Cd1	895	928	CdO, monteponite	TEM ζ potential	19
Cd2		784			
Cd3		856			
Cd4		821			
Cd5		888			
Cd6		928			
Cd7		833			
Cd8		816			
Cd9		849			
Cd10		852			
Cd11		862			
Ce1	672	912	CeO_2, cubic		20
Ce2	812	629	CeO_2	TEM	21
Ce3	662	797			22
Ce4		864			

Ce5		912		UV-vis	
Ce6	807	703	CeO_2, 3.0 nm	Raman XPS FTIR UV-Vis TPR-TG TPR-DTG	23
Ce7	941	913		TEM	24
Ce8		885		TEM	
Ce9		512		XPS	
Ce10		509		TEM	
Ce11	739	896	-	Raman	25
Ce12		876	CeO_2, *cubic*, 11 nm	UV-vis	
Ce13		782	CeO_2, *cubic*, 20 nm		
Ce14		696	CeO_2, *cubic*, 25 nm		
Ce15	720	542	CeO_2, 12.6 nm	UV-vis XPS FTIR	26
Ce/Ni11	687	600	Ni	TEM	27
Ce/Ni12		540		H_2-TPR	
Ce/Ni13		538	CeO_2	EELS	
Ce/Ni14		514		TPO TGA DTA	
Ce/Zr1	720	537	CeO_2, 7.9 nm	UV-vis XPS	26

				FTIR TEM	
Ce/Zr2		550	CeO_2, 14.0 nm	UV-vis XPS FTIR	
Co1	672	478	Co_3O_4, spinel, 7.6 nm	H_2-TPR	20
Co2				TEM SEM XRF TPO	28
Co3					
Co4					
Co5	608	511			29
Co6		490		HRTEM	
Co7		468			
Co8		292			
Co9		506	Co_3O_4		
Co10			Co_3O_4, 14 nm	SEM TEM FTIR	30
Co11				FTIR	
Co12					
Co13		539	Co_3O_4, cubic spinel, 9.4 nm	TEM H_2-TPR	31
Co14	699	589	Co_3O_4,7 nm	TEM H_2-TPR EDS	32
Co15	775	283		FFT TGA	33

				HRTEM H_2-TPR DRM XPS	
Co16	803	639	Co_3O_4, cubic, 8.6 nm	TEM HRTEM EDXS H_2-TPR	34
Co17	738	280	Cobalt silicate hydroxide	TEM XANES H_2-TPR XPS	35
Co18	781	628	Co_3O_4, 11.5 nm	SEM	36
Co/Al1				TGA	15
Co/Ca1		283		TEM H_2-TPR	31
Co/Ce1	672	529	Co_3O_4, spinel, 10.6 nm CeO_2, cubic	H_2-TPR	20
Co/Ce2	662	452	CeO_2, cubic Co_3O_4, spinel, 10.9 nm		22
Co/Ce3		496	CeO_2, cubic Co_3O_4, spinel, 10.7 nm		
Co/Ce4		530	CeO_2, cubic Co_3O_4, spinel, 10.6 nm	UV-vis	
Co/Ce5		556	CeO_2, cubic		

			Co_3O_4, spinel, 6.2 nm		
Co/Ce6		584	CeO_2, cubic Co_3O_4, spinel, 2.3 nm	UV-vis	
Co/Ce7		418			
Co/Mg1		333	Co_3O_4, cubic spinel, 6.6 nm	TEM H_2-TPR	31
Co/Mo1	775	662	β-$CoMoO_4$	HRTEM H_2-TPR UV-vis	37
Co/Mo2		581			
Co/Mo3		551			
Co/Mo4		529			
Co/Mo5		483			
Co/Mo6		442			
Co/Mo7		543			
Co/Mo8		471			
Co/Mo9		435			
Co/Ni1	819	469	$CoCo_2O_4$, spinel	EDX H_2-TPR CO_2-TPR TEM TGA DTA	38
Co/Ni2		426			
Co/Ni3		584			
Co/Ni4		528			
Co/Ru1	699	629	Co_3O_4, 10.5 nm RuO_2, 16.6 nm	TEM EDS	32
Co/Ru2		425	Co_3O_4, 9.5 nm RuO_2, 40.5 nm	TEM TPO H_2-TPR EDS	

Co/Ru3		472	Co_3O_4 RuO_2, 13.2 nm	TEM EDS	
Cu1	807	678	CuO, 43.8 nm	Raman XPS FTIR UV-Vis TPR-TG TPR-DTG	23
Cu2	574	355	CuO	H_2-TPR	39
Cu3		320	CuO		
Cu4		368	CuO Cu_2O		
Cu/Al1		346		HRTEM TG DTG FTIR	14
Cu/Ce1	807	690	CuO, 49.2 nm	Raman XPS FTIR UV-Vis TPR-TG TPR-DTG	23
Cu/Ce2		692	CuO, 19.1 nm		
Cu/Ce3		626			
Cu/Ce4	720	501	CeO_2, 29.0 nm	UV-vis XPS FTIR	26
Cu/Ce5		509	CeO_2, 14.0 nm		

				TEM	
Cu/Ce6		504	CeO_2, 9.6 nm	UV-vis XPS FTIR	
Cu/Ni1	816	717	NiO, cubic, 29.5 nm, CuO, monoclinic, 14.5 nm	TEM HRTEM H_2-TPR XPS	40
Cu/Ni2		699			
Cu/Ni3		458			
Cu/Ni4		323			
Cu/Zn1		423		HRTEM TG DTG FTIR	14
Cu/Zr1	720	497		UV-vis XPS FTIR	26
Fe1				TEM	41
Fe2				FTIR	
Fe3				TGA	
Fe4					
Fe/Al1					15
Ga1	1050	950	Ga_2O_3	^{71}Ga-MAS-NMR TEM	16
K/Mo1				H_2-TPR	42
K/Mo2					
K/Mo3			K_2MoO_4		
K/Mo4					

La/Ni1	620	81			43
La/Ni2		65			
La/Ni3		23			
La/Ni4	612	246	$LaNiO_3$, type perovskite	TEM EDX TG DTA H_2-TPR	44
Mg1	581	350		TEM H_2-TPR TGA	17
Mo1			MoO_3	H_2-TPR	42
Ni1	872	491	NiO, 3.3 nm	TEM Raman TGA FTIR	45
Ni2	884	639	NiO, cubic, 12 nm	HRTEM TG H_2-TPR	46
Ni3		391	NiO, cubic		
Ni4		306	NiO, cubic		
Ni5	912	556		DRIFT	47
Ni7			Ni, 10.6 nm	TGA THP H_2-TPR	24
Ni8		401	NiO, 10.6 nm	TEM HRTEM	48
Ni9	581	545	NiO, cubic, 14.8 nm	TEM H_2-TPR TGA	17, 31
Ni10	675	505	NiO, 94 nm	TEM	49

Ni11		480	NiO, 120 nm	H2-TPR	
Ni12		420	NiO, 123 nm		
Ni13		400	NiO, 271 nm		
Ni14		380	NiO, 310 nm		
Ni15	598	455	NiO, cubic, 5.5 nm	TEM H_2-TPR	50
Ni16	646	528	NiO, cubic, 3.3 nm		
Ni17	614	515	NiO, cubic, 5.9 nm		
Ni18	782	401	NiO, 9.8 nm	TEM SEM H_2-TPR TPO	51
Ni19	775	320		FFT TGA HRTEM H_2-TPR DRM XPS	33
Ni20	756	620	NiO	SEM TEM EDS H_2-TPR	52
Ni21		600			
Ni22		422			
Ni23		476			
Ni24	739	594	Ni, 8.0 nm	Raman UV-vis	25
Ni25	799	582	NiO, cubic, 8.7 nm	H_2-TPR XP TEM TG TPO	53

				Raman	
Ni29	790	586	NiO, 13.0 nm	TEM	54
Ni30		586	NiO, 9.3 nm	Raman	
Ni31		593		TGA DCS	
Ni32		549		TEM Raman TGA DSC XPS	
Ni33		573		TEM Raman TGA DSC	
Ni34		588		TEM Raman TGA DSC XPS	
Ni35	815	534	NiO	TEM	55
Ni36		529		H_2-TPR TGA	
Ni37	810	511	NiO	TEM	56
Ni38		579		H_2-TPR	
Ni39		552		TGA	
Ni40		663		TG DSC	
Ni41	913	814	NiO, 8.0 nm	UV-vis	57

Ni42		783	NiO, 10.9 nm	TGA H_2-TPR HRTEM	
Ni43		764	NiO, 13.8 nm		
Ni44		733	NiO, 16.7 nm		
Ni45		565	NiO, 18.3 nm		
Ni46		657			
Ni47		589			
Ni48		563			
Ni49		529			
Ni50		411	NiO, 6.0 nm		
Ni51			NiO, 13.0 nm after reaction Ni, 14.3 nm	TEM Raman FTIR ^{1}H NMR TPO TGA-DSC	58
Ni52			NiO, 8.9 nm after reaction Ni, 11.5 nm		
Ni53			NiO, 4.6 nm after reaction Ni, 8.0 nm		
Ni54			NiO, 4.3 nm after reaction Ni, 8.5 nm		
Ni55			NiO, 4.7 nm after reaction Ni, 8.2 nm		
Ni56			NiO, 15.7 nm after reaction Ni, 17.2 nm		
Ni57			NiO	H_2-TPR TEM TG	59
Ni58					
Ni59			NiO, 10.1 nm		

Ni60			NiO	DSC	
Ni61					
Ni62	687	616	Ni	TEM H_2-TPR EELS TPO TGA DTA	27
Ni63	682	578	NiO	H_2-TPR TEM TG DSC	60
Ni64		551			
Ni65	738	283	Nickel silicate hydroxide	TEM XANES H_2-TPR XPS	35
Ni66	652	494	Ni	TG DT	61
Ni67	781	401	NiO, 8.95 nm	SEM	36
Ni/Al1			NiO	SEM EDS TG	15
Ni/Ca1	581	291	NiO, cubic, 6.7 nm	TEM H_2-TPR	17, 31
Ni/Ce1				TEM THP XPS H_2-TPR	24
Ni/Ce2			Ni, 7.2 nm	TEM TGA	

				THP XPS H_2-TPR	
Ni/Ce3			Ni, 8.6 nm	TEM TGA THP	
Ni/Ce4				TEM THP H_2-TPR	
Ni/Ce5		650	NiO, 14 nm CeO_2, 5 nm	TEM H_2-TPR	62
Ni/Ce6		607	NiO, 6 nm CeO_2, 4 nm		
Ni/Ce7	739	624	Ni, 8.2 nm	H_2-TPR	25
Ni/Ce8	799	453	NiO, cubic, 5.6 nm CeO_2, cubic	H_2-TPR XP TEM TG TPO Raman	53
Ni/Ce10		479	NiO, cubic, 6.4 nm		
Ni/Ce11	856	377	NiO, cubic, 10.2 nm CeO_2, 7.6 nm	H_2-TPR FTIR XPS TGA	63
Ni/Ce12		357	NiO, cubic, 9.5 nm CeO_2, 6.9 nm		
Ni/Ce13		414	NiO, cubic, 9.9 nm CeO_2, 7.4 nm		
Ni/Co1	775	316		FFT	33

Ni/Co2		294		TGA HRTEM H_2-TPR DRM	
Ni/Co3		327		FFT TGA HRTEM H_2-TPR DRM XPS	
Ni/Co4		285		FFT	
Ni/Co5		303		TGA HRTEM H_2-TPR DRM	
Ni/Co6				TGA	15
Ni/Co7	738	261	Nickel silicate hydroxide Cobalt silicate hydroxide	TEM XANES H_2-TPR XPS	35
Ni/Mg1			Ni, 14.2 nm NiO-MgO solid solution	H_2-TPR TPO TEM	64
Ni/Mg2			Ni, 16.9 nm NiO-MgO solid solution		
Ni/Mg3			Ni, 21.0 nm NiO-MgO solid solution		
Ni/Mg4			Ni, 12.2 nm		

			NiO-MgO solid solution		
Ni/Mg5			Ni, 18.2 nm NiO-MgO solid solution		
Ni/Mg6	581	313	NiO, cubic, 13.8 nm	TEM H_2-TPR	17,31
Ni/Sm1	782	663	NiO, 13.8 nm		51
Ni/Sm2		582	NiO, 8.6 nm		
Ni/Sm3		423	NiO, 7.3 nm	XRF TEM SEM H_2-TPR TPO	
Ni/Sn1			Ni_3Sn_2 (alloy)	SEM EDS TG	15
Ni/W1	652	148		TG DT	61
Ni/W2		394	WO_2		
Ni/W3		211	Ni_4W (alloy)		
Ni/W4		151	W	TEM/EDX SEM TGA TG DT	
Ni/Y1		434	NiO, 10.5 nm	TEM HRTEM	48
Ni/Zr1		568	NiO, 11.7 nm		
Ni/Zr2	799	474	NiO, cubic, 5.4 nm	H_2-TPR XP TEM	53

			ZrO_2, monoclinic	TG TPO Raman	
Ni/Zr3	652	561	Ni	TG DT	61
Sm/Co1	781	652	Co_3O_4, 11.5 nm		36
Sm/Co2		564	Co_3O_4, 9.85 nm	TEM HRTEM H_2-TPR SEM TGA	
Sm/Co3		740	Co_3O_4, 13.95 nm		
Sm/Ni4		423	NiO, 9.7 nm	TEM HRTEM	48
Sm/Ni1	781	663	NiO, 9.43 nm		36
Sm/Ni2		468	NiO, 7.26 nm	TEM HRTEM H_2-TPR SEM TGA	
Sm/Ni3		582	NiO, 8.22 nm		
Sn/Al1			SnO	SEM	15
Ti1	910	666	No crystalline Ti compounds	ζ potential TEM	13
Ti2		800			
Ti3		596			
Ti4		751			
Ti5		870			
Ti6		409			
Ti7		476			

Ti8		634			
Ti9		629			
Ti10		595			
Ti11		580			
Ti12		523			
Ti13		471			
Ti/Al1		889	No crystalline Ti or Al compounds		
Ti/Al2		919			
Ti/Al3		679			
Ti/Al4		728			
V1	780	600		UV-vis Raman H_2-TPR SEM	65
V2		300			
V3	793	502	V_2O_5	UV-vis H_2-TPR SEM EDX Raman	66
V4		487			
V5		480			
V6		468			
V7		419			
Zn2	618	609	ZnO, zincite		19
Zn3		680			
Zn4		680			
Zn5		448			
Zn6		373			
Zn7	1109	726			
Zn8		584			
Zn9		481			
Zn10		323			
Zn11		495			
Zn12		269			

Zn/Al1		488		HRTEM TG DTG FTIR	14
Zr1	742	521		TEM ^{31}P MAS NMR ^{29}Si MAS NMR NH_3-TPD	67
Zr2	720	542		UV-vis XPS FTIR	26
Zr3	652	608		TG DT	61
Zr/Ce1	884	423	NiO, cubic, 11 nm	TEM HRTEM H_2-TPR TGA	68
Zr/Ce2		472	NiO, cubic, 9 nm		
Zr/Ce3		489	NiO, cubic		
Zr/P1	742	516	zirconium phosphate	TEM ^{31}P MAS NMR ^{29}Si MAS NMR NH_3-TPD	67
Zr/P2		489			
Zr/P3		400			
Zr/P4		279			