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SUPPORTING INFORMATION

Nickel oxide supported on Porous Clay Heterostructures as selective catalysts for the oxidative dehydrogenation of ethane

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Experimental information

Surface coverage

5NiSi and 17NiPCH have similar NiO coverage of the support (ca. 3.10^{-4} g of NiO per m^2 of support).

5NiSi presents 5 wt.% of NiO and 95 wt.% of silica. Silica has a surface area of 181 m^2/g. Therefore for 1 g of catalyst, 0.05 g of NiO are spread over 0.95 g of support, which corresponds to 171.95 m^2. Then, there are $2.91.10^{-4}$ g of NiO per m^2 of support.

17NiPCH presents 17 wt.% of NiO and 83 wt.% of PCH. PCH has a surface area of 644 m^2/g. Therefore for 1 g of catalyst, 0.17 g of NiO are spread over 0.83 g of support, which corresponds to 534.52 m^2. Then, there are $3.18.10^{-4}$ g of NiO per m^2 of support.

Table S1. Physicochemical characteristics of the PCH supports.

Sample	S_{BET} (m^2g^{-1})	t-plot microp ($m^2\ g^{-1}$)	V_P ($cm^3\ g^{-1}$)	V_P microp• ($cm^3\ g^{-1}$)	Pore size (nm)	Acidity $\mu molNH_3\ g^{-1}$	Acidity $\mu molNH_3\ m^{-2}$
Montmorillonite	49	18	0.109	0.009	12.4	125	2.55
PCH	644	460	0.773	0.280	5.5	308	0.48
PCH-Ti	562	287	0.796	0.164	6.8	395	0.70

Table S2. Catalytic performance of pure supports in the oxidation of ethane at 450ºC.[a]

Catalyst	W/F [b]	Ethane Conversion,%	Selectivity, % Ethylene	CO_x
Si	8	0.02	0	100
PCH	8	0.15	62	38
PCH-Ti	8	0.16	64	36

[a] Reaction conditions detailed in the experimental part of the text; [b] Contact time in g_{cat} h $(mol_{C2})^{-1}$

Table S3. Temperature programmed $^{18}O_2$ isotopic exchange (TPIE) results.

Catalyst	T_{onset} $^{16}O_2$ (ºC)	T_{onset} $^{16}O^{18}O$ (ºC)	Area $^{16}O_2/^{16}O^{18}O$ [a]
10NiSi	Not observed	377	<0.1
10NiPCH	419	425	1.12
10NiPCH-Ti	419	450	1.32

[a] relative amount of O-species released until 650ºC.

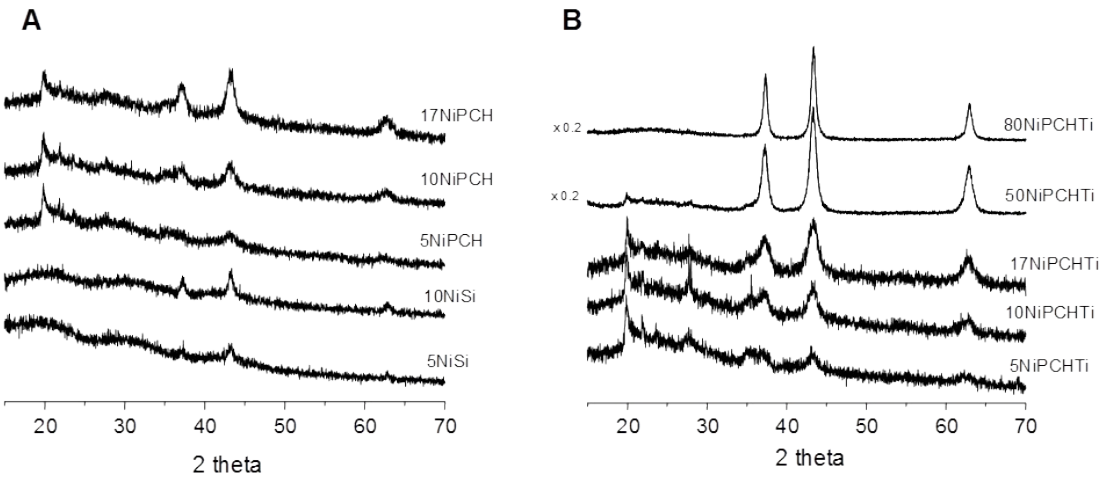

Figure S1. XRD patterns for NiO catalysts supported on conventional silica (NiSi-series) and pillared clays (both NiPCHSi- and NiPCH-Ti-series)

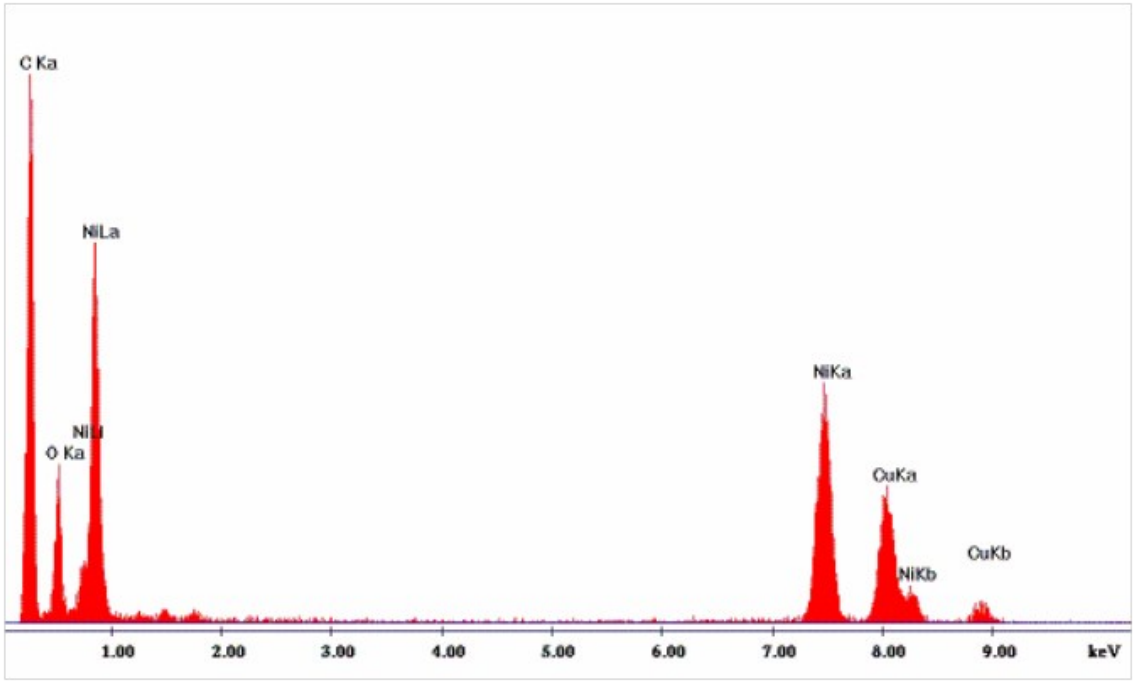

Figure S2. Local EDX spectrum of a single NiO nanoparticle in **17NiPCH-Ti**.

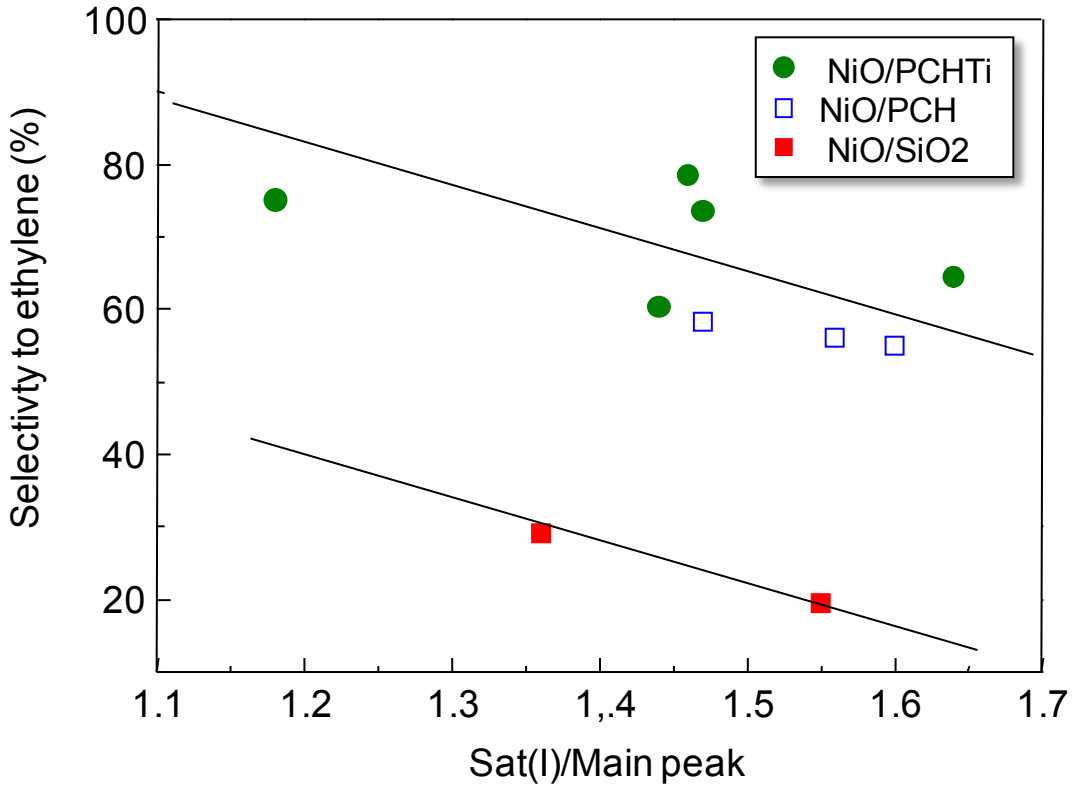

Figure S3. Relationship between selectivity to ethylene and the Sat(I)/Main peak ratio determined by XPS. Note: Selectivity to ethylene as in Figure 6.

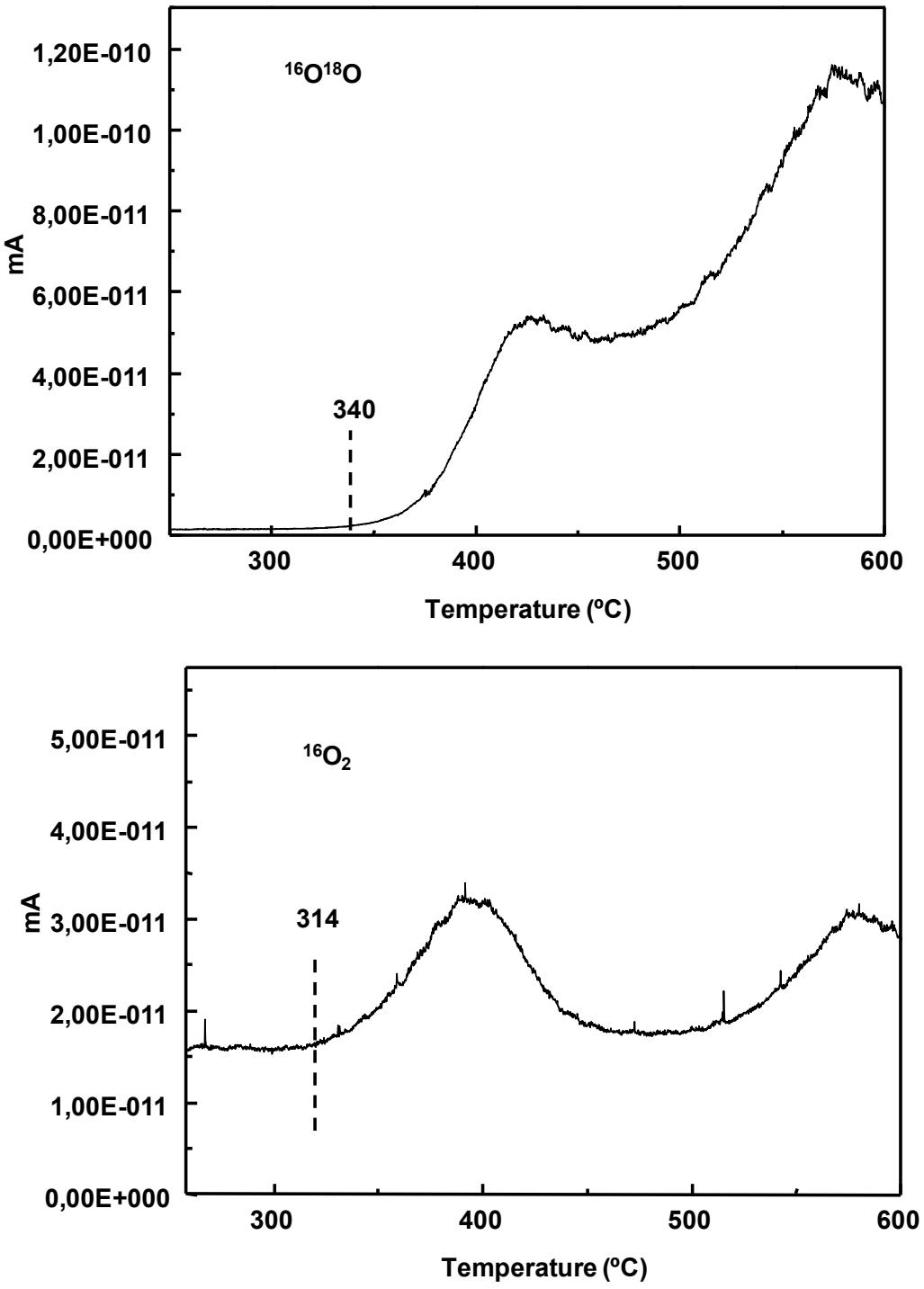

Figure S4. Evolution of the oxygen exchange ($^{16}O^{18}O$ and $^{16}O_2$) formation species per Ni atom during TPIE experiments versus temperature over NiO catalyst.