Enhancing the catalytic performance of Ni based catalysts in toluene reforming at low temperature by structuration on SiC extrudates

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Supporting information

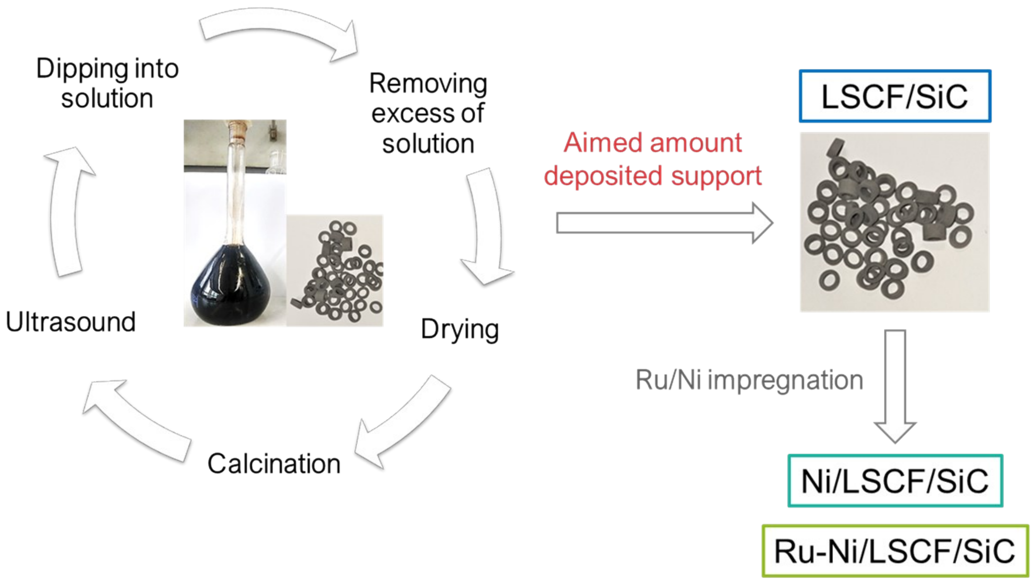

Fig 1S. Dip coating procedure of the LSCF precursor solution and impregnation of active phases (Ni and Ru)

Table 1S. Elemental composition of β-SiC-based extrudates (provided by SICAT)

	Fe	Al	Ca	Na	K	S
Composition (ppm)	3000	1000	400	80	100	50

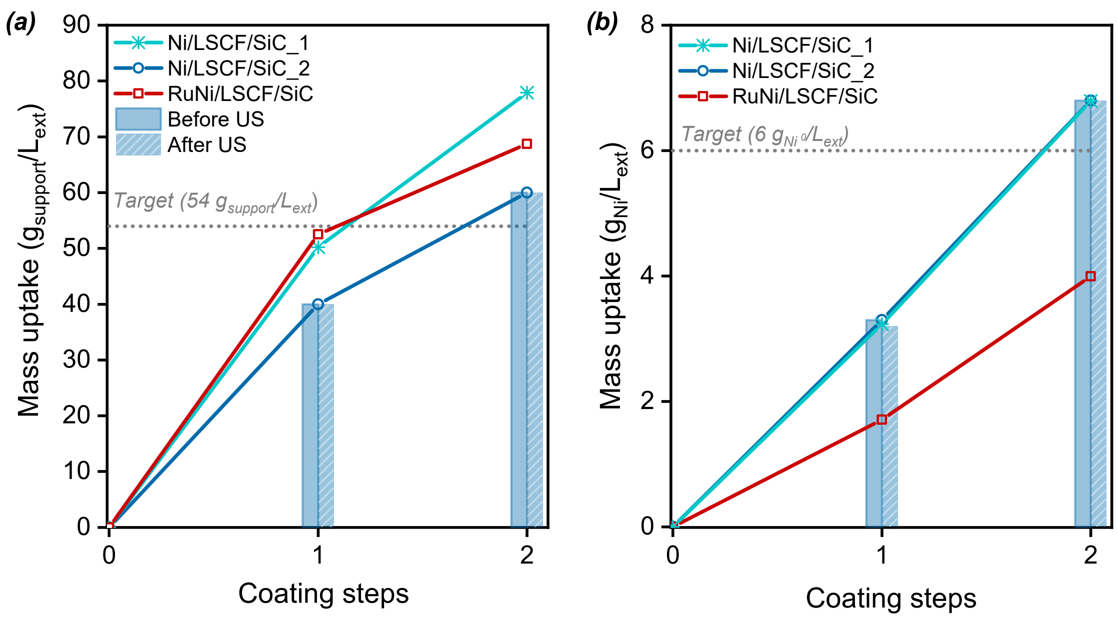

Fig 2S. *Mass uptake and ultrasound test after the coating of* ***(a)*** *LSCF and* ***(b)*** *Ni for several batches.*

Table 2S. *Mass uptake and Ni loading of the batches prepared.*

	Mass uptake LSCF (g/L_{ext})	*Mass uptake of Ni (g/L_{ext})*	*Ni loading (%)*
Ni/LSCF/SiC_1	*77.9*	*6.8*	*8.0*
Ni/LSCF/SiC_2	*60.0*	*6.8*	*10.2*
RuNi/LSCF/SiC	*68.7*	*4.0*	*5.5*

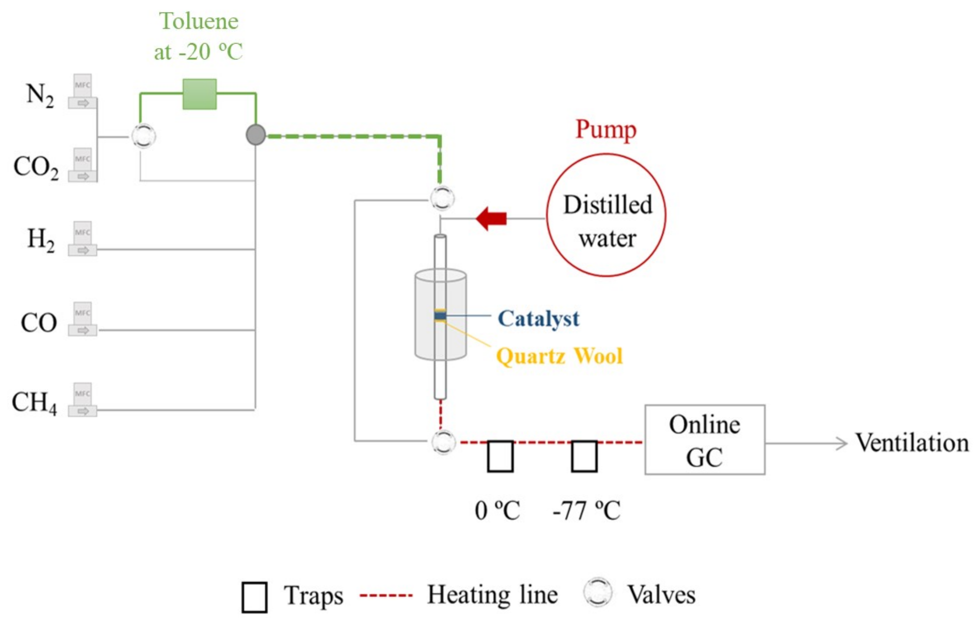

Fig 3S. *Scheme of the lab scale plant used for toluene reforming reaction (adapted from ref* [1])

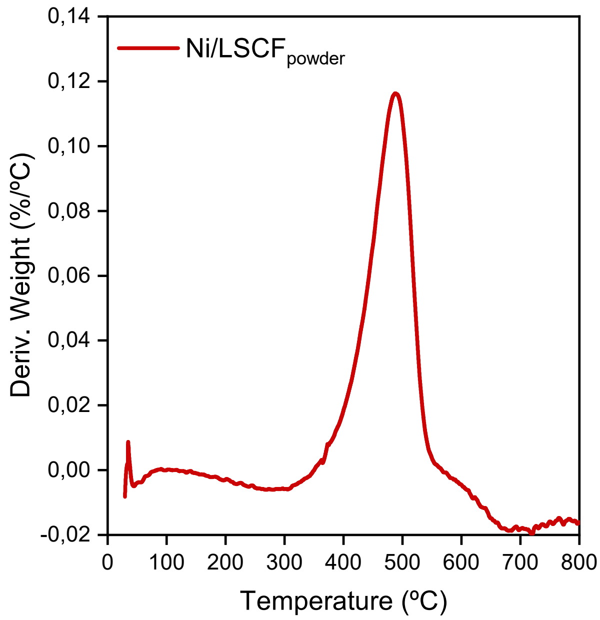

Fig 4S. *Derivative of the TGA curve versus temperature of Ni/LSCFpowder after the pre-treatment under model ex-biomass atmosphere.*

Table 3S. H_2 consumption and support reducibility of powdered and structured catalysts

	H_2 consumption (mmol/g$_{catalyst}$)	***Support reducibility (%)***
LSCF$_{solution}$	*4.4*	*31*
Ni/LSCF$_{powder}$	*5.9*	*54*
RuNi/LSCF$_{powder}$	*5.4*	*56*
LSCF/SiC	*1.4*	*10*
Ni/LSCF/SiC	*4.6*	*38*
RuNi/LSCF/SiC	*4.9*	*40*

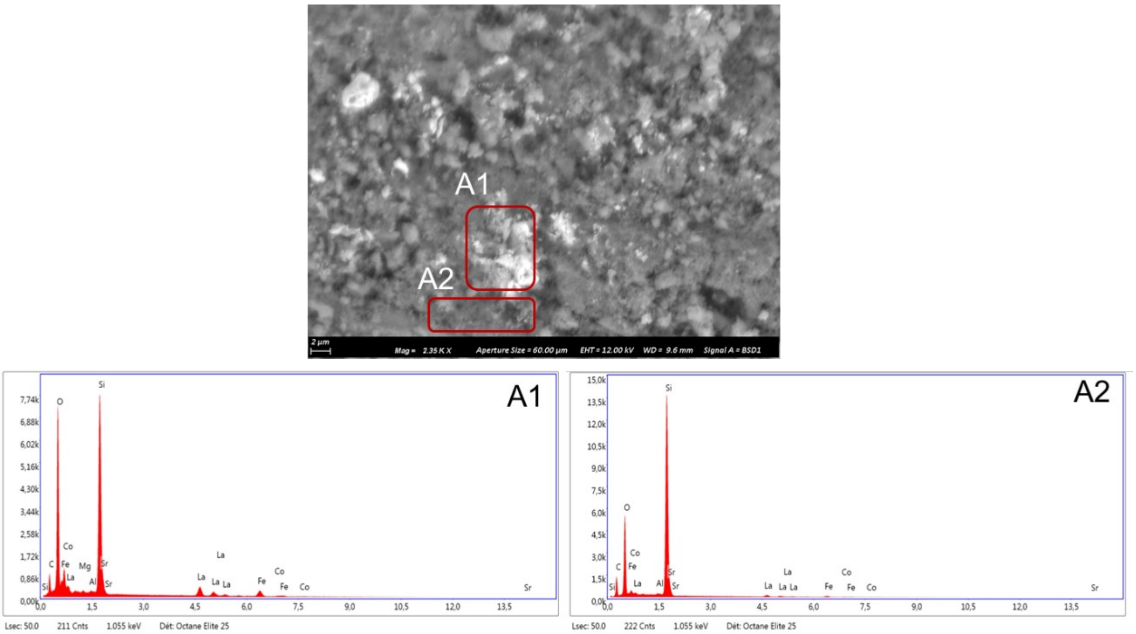

Fig 5S. SEM image and EDX analyses of LSCF/SiC

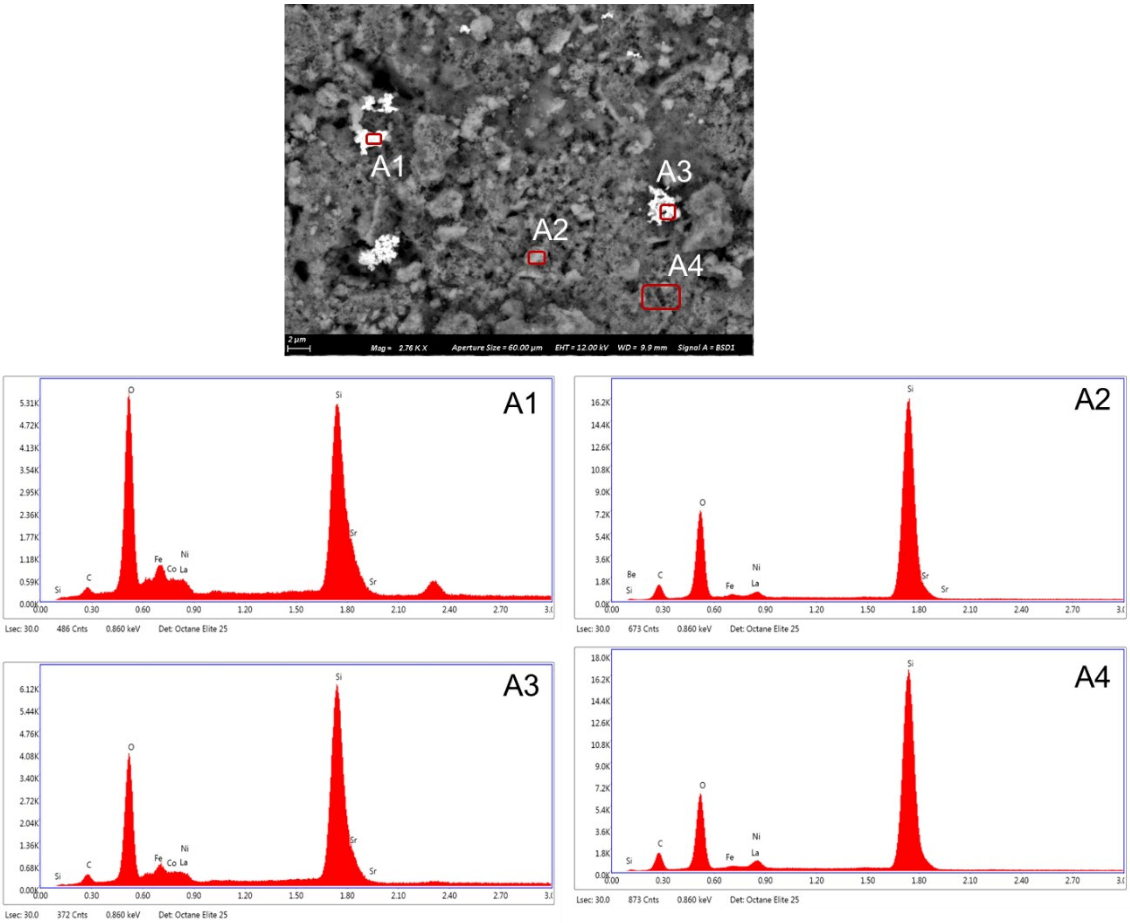

Fig 6S. SEM image and EDX analyses of Ni/LSCF/SiC

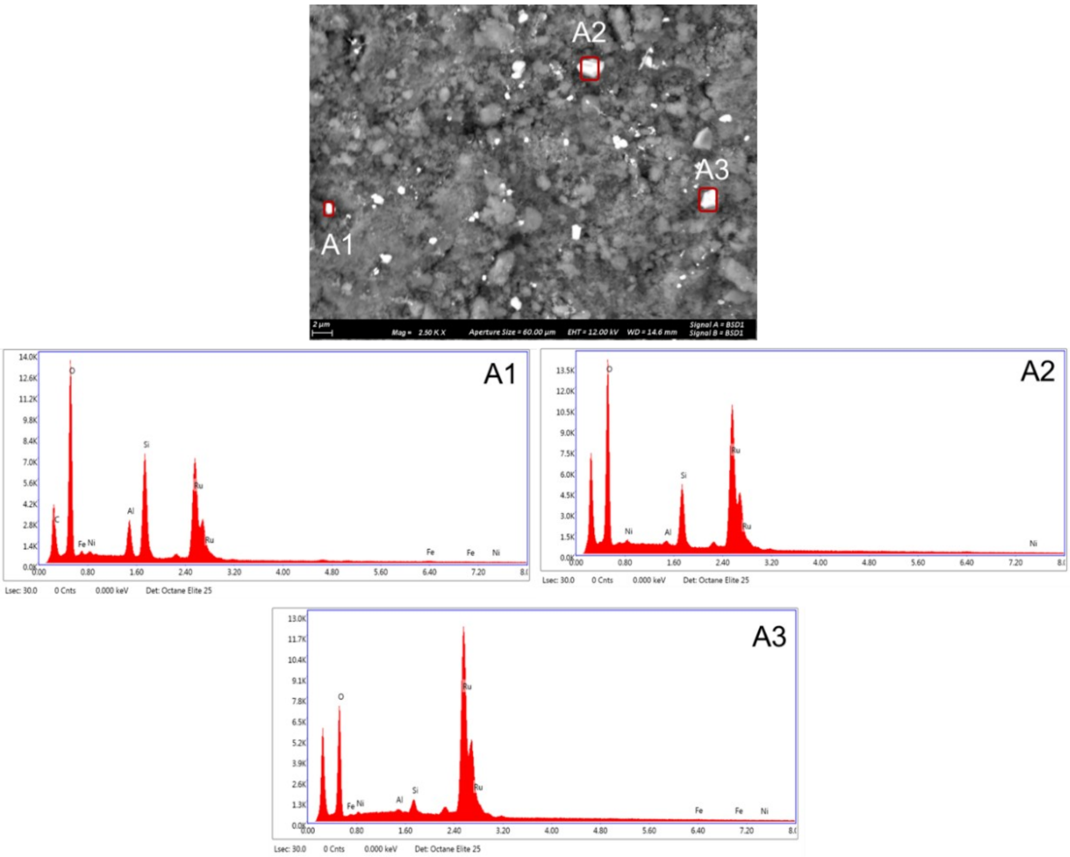

Fig 7S. SEM image and EDX analyses of RuNi/LSCF/SiC

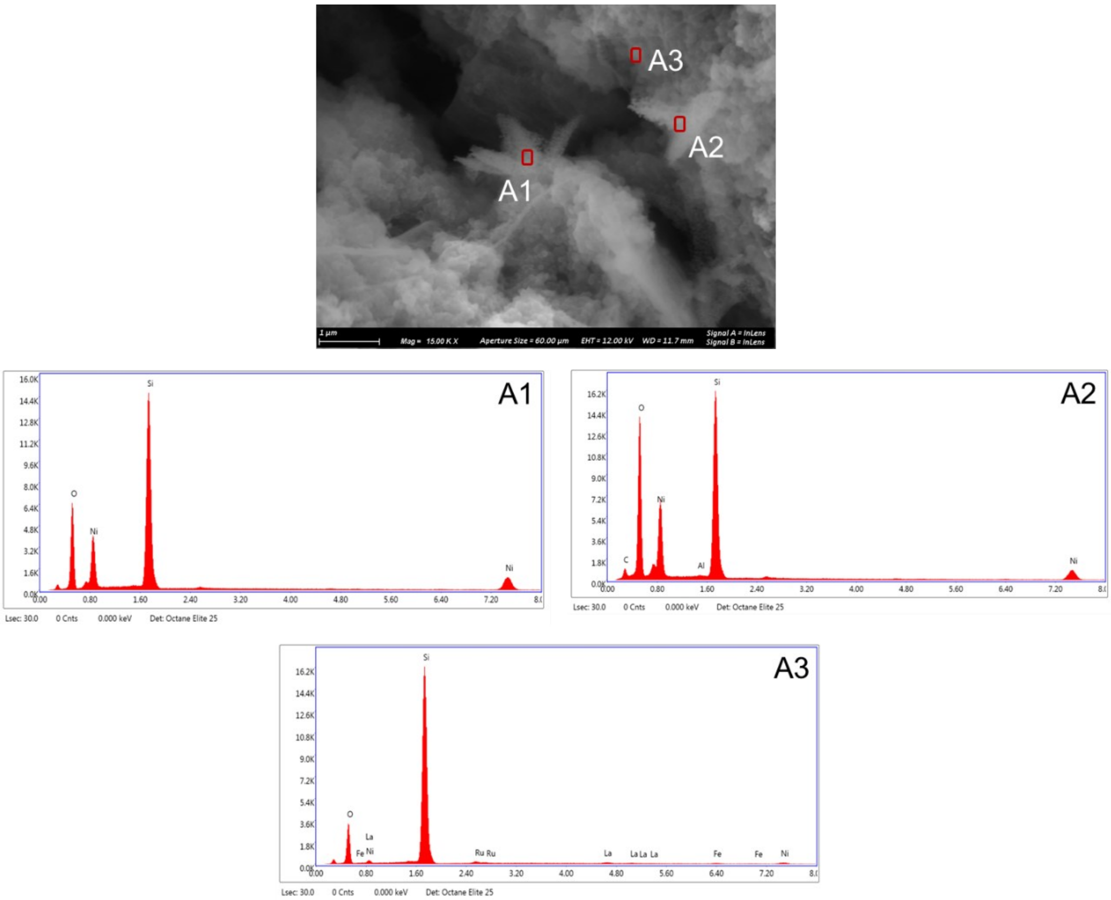

Fig 8S. SEM image and EDX analyses of RuNi/LSCF/SiC

The variation of the partial molar flows of each gas compound compared to the inlet one (dashed lines) versus time during toluene reforming for LSCF after pre-treatment in H_2 atmosphere (prior reported in ref [2]) and (Ru)Ni/LSCF after pre-treatment in model ex-biomass atmosphere is presented in ***Fig 7S.*** It can be observed that same catalytic activity toward WGS is exhibited for the catalysts pre-treated under model ex-biomass atmosphere and the bare support pre-treated under H_2.

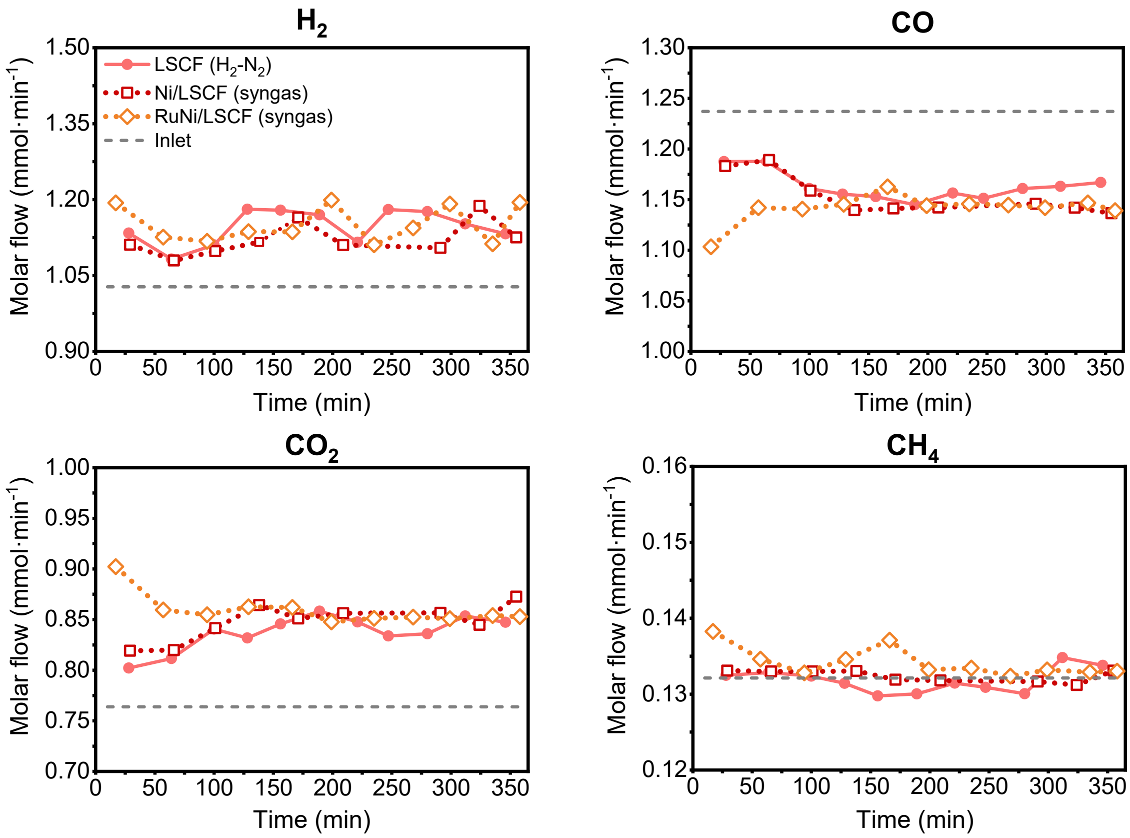

Fig 9S. Partial molar flows at the outlet of the reactor vs time during toluene reforming at 550 °C for 6 h over (Ru)Ni/LSCF catalysts and bare LSCF

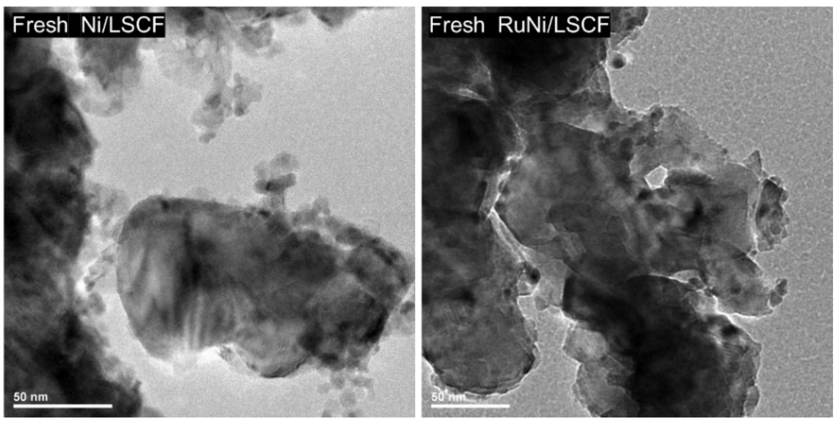

Fig 10S. TEM images of fresh (Ru)Ni/LSCF (adapted from ref [2])

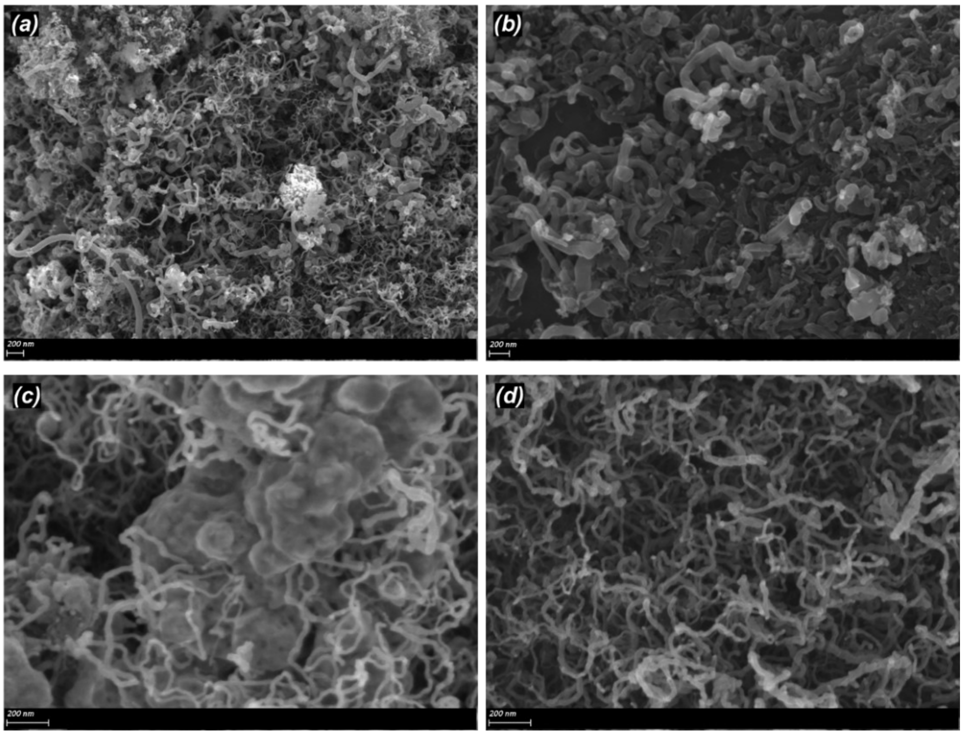

Fig 11S. SEM images after toluene reforming reaction at 550 ºC for 6 h of ***(a)*** Ni/$LSCF_{powder}$; ***(b)*** RuNi/$LSCF_{powder}$; ***(c)*** Ni/LSCF/SiC and ***(d)*** RuNi/LSCF/SiC

References

[1] L. Jurado, V. Papaefthimiou, S. Thomas, and A. Roger, “Low temperature toluene and phenol abatement as tar model molecules over Ni-based catalysts: Influence of the support and the synthesis method,” *Appl. Catal. B Environ.*, vol. 297, p. 120479, Nov. 2021, doi: 10.1016/j.apcatb.2021.120479.

[2] L. Jurado, V. Papaefthimiou, S. Thomas, and A.-C. Roger, “Upgrading syngas from wood gasification through steam reforming of tars over highly active Ni-perovskite catalysts at relatively low temperature,” *Appl. Catal. B Environ.*, vol. 299, p. 120687, Dec. 2021, doi: 10.1016/j.apcatb.2021.120687.