

Supporting Information

Sorbent-enhanced steam methane reforming over a Ni-Ca-based, bi-functional catalyst sorbent

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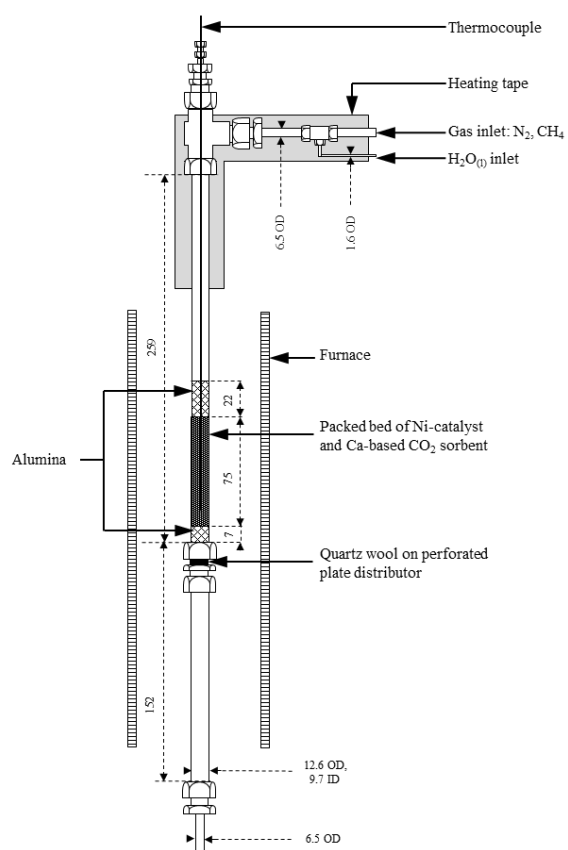


Figure S1. Schematic diagram of the fixed-bed reactor in which the cyclic SE-SMR reaction was performed at 550 °C.

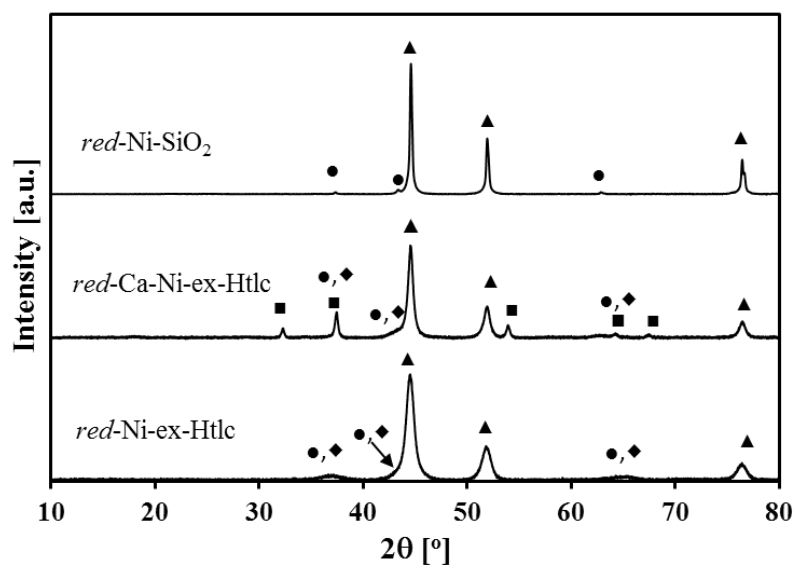


Figure S2: X-ray diffraction patterns of reduced nickel based catalysts. The following compounds were identified: (▲) nickel, (●) – bunsenite, NiO, (◆) – periclase, MgO, (■) – lime, CaO, (◇) - magnesium nickel oxide, MgNiO_2 and (○) – nickel aluminium oxide, NiAl_2O_4 .

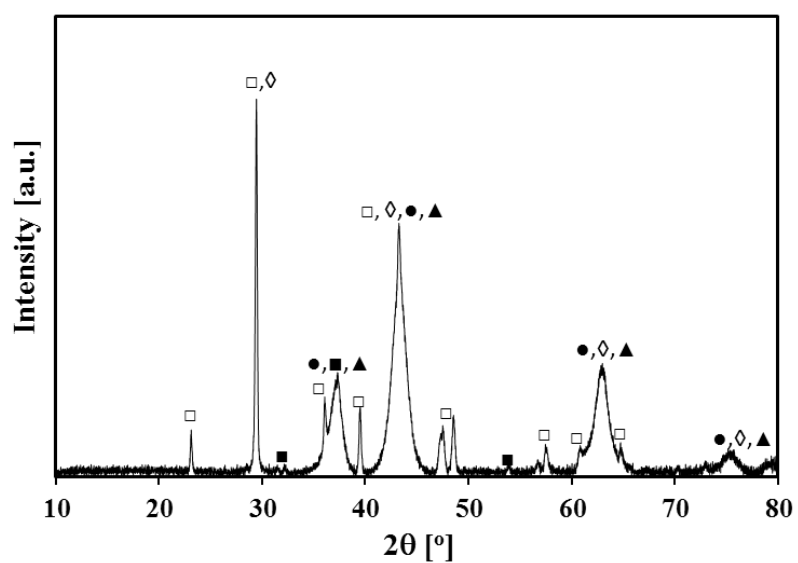


Figure S3. X-ray diffraction patterns of carbonated Ca-Ni-ex-Htlc. The following compounds were identified: (□) – calcite, CaCO_3 , (■) – lime, CaO , (●) – bunsenite, NiO , (◇) – periclase, MgO and (▲) – magnesium nickel oxide, $\text{MgO} \cdot \text{NiO}$.

Table S1. The conversion of methane and the mole fraction of H₂ during the 1st, 5th and 10th cycle for the catalysts used. At thermodynamic equilibrium, the conversion of methane and the mol fraction of hydrogen for the SE-SMR reaction at 550 °C are 99 % and 0.99, respectively.

1 st cycle		
Sorbent	CH ₄ conversion [%]	H ₂ mole fraction
Ca-Ni-ex-Htlc	96 (150s)	0.99 (150s)
Ni-ex-Htlc	95 (300s)	0.98 (300s)
Ni-SiO₂	92 (60s)	0.98 (60s)
5 th cycle		
Sorbent	CH ₄ conversion [%]	H ₂ mole fraction
Ca-Ni-ex-Htlc	96 (150s)	0.99 (150s)
Ni-ex-Htlc	97 (150s)	0.99 (150s)
Ni-SiO₂	-	-
10 th cycle		
Sorbent	CH ₄ conversion [%]	H ₂ mole fraction
Ca-Ni-ex-Htlc	95 (150s)	0.98 (150s)
Ni-ex-Htlc	96 (90s)	0.98 (90s)
Ni-SiO₂	-	-

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