Supporting Information for

Effects of thermal pretreatment and catalyst on biomass gasification efficiency and syngas composition

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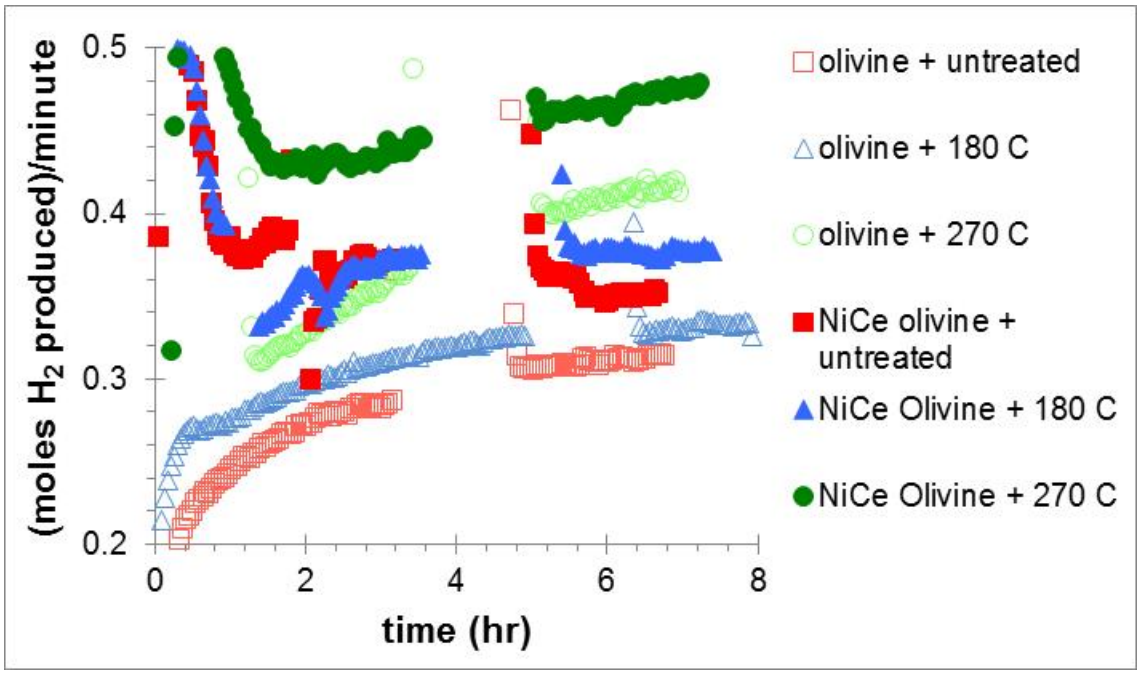
Figure S1.



Figures S1. Number of moles of hydrogen gas produced as a function of time. The gap in the data occurred because the helium tracer used to calculate volume of gases produced was switched off during that time period; instead argon was flowed as a tracer for the MBMS.

Table S1. Fraction carbon in different phases under different combinations of feedstock and fluidized bed materials.

Feedstock	**Fluidized bed material**	**Field to fuel fraction carbon**				**Total carbon**
		Lost during thermal treatment	In light gas (±0.057)[1]	In char (±0.006) [1]	In tar (±0.010) [2]	(sum of all fractions)
untreated	Olivine	0	0.803	0.029	0.228	1.060
180 °C	Olivine	0 ± 0.014	0.798	0.033	0.197	1.028
270 °C	Olivine	0.174 ± 0.014	0.651	0.063	0.089	0.977
untreated	Ni-Ce Olivine	0	0.880	0.031	0.136	1.047
180 °C	Ni-Ce Olivine	0 ± 0.014	0.903	0.033	0.128	1.064
270 °C	Ni-Ce Olivine	0.174 ± 0.014	0.696	0.059	0.068	0.996

[1]These uncertainties included run-to-run variabilities; they were calculated as the average of three standard deviations, which were in turn calculated from repeat runs of the same conditions.
[2]The uncertainty was calculated from average of the standard deviations within each experiment.

The fraction carbon lost during thermal treatment was calculated using the equation: Fraction carbon loss = 1-(m*cpt/cbt), where m = mass yield after treatment (as listed in Table 1), cpt = carbon content after thermal treatment as measured in ultimate analysis (Table 2), and cbt = carbon content before treatment (Table 2), with the uncertainties of the carbon lost during thermal treatment as the sum of the uncertainties of m, cpt, and cbt. As shown in Table 3, the mild thermal treatment (180 °C) has no measurable carbon loss, while the 270 °C torrefaction resulted in a loss of 0.174 or 17.4% of the original carbon content.

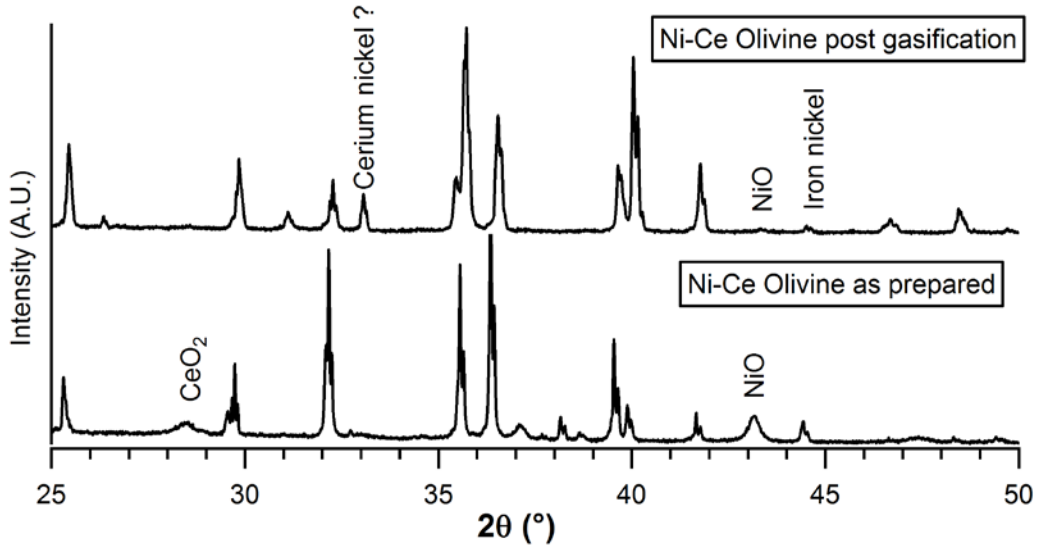


Figure S2. X-ray diffraction of the as-prepared and post-gasification Ni-Ce Olivine fluidized bed material. The lines that are not labelled are from forsterite, a magnesium silicate (Mg_2SiO_4).