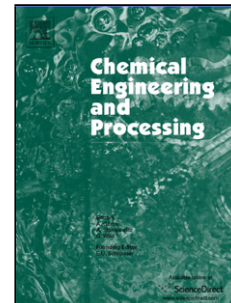


Accepted Manuscript

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PII: S0255-2701(17)30013-2
DOI: <http://dx.doi.org/doi:10.1016/j.cep.2017.05.003>
Reference: CEP 6987

To appear in: *Chemical Engineering and Processing*

Received date: 8-1-2017
Revised date: 6-4-2017
Accepted date: 5-5-2017

Please cite this article as: Chemical looping dry reforming of methane: towards shale-gas and biogas valorization, *Chemical Engineering and Processing* (2017), <http://dx.doi.org/10.1016/j.cep.2017.05.003>

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Chemical looping dry reforming of methane: towards shale-gas and biogas valorization

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Abstract

Chemical looping dry reforming of methane (CLDRM) is performed by exposing a Ni/CeO₂ to CH₄ and CO₂ in a cyclic way. The solid acts as oxygen carrier producing syngas (CO+H₂) during exposure to CH₄, and is re-oxidized during exposure to CO₂. Absence of CO₂ during syngas production avoids reverse water gas shift reaction and allows high selectivity. Oxygen capacity is restored and residual carbon formed at the surface is removed during exposure to CO₂. In view of biogas reforming without prior separation of compounds, CLDRM is tested in presence of CO₂ in the CH₄ feed. CLDRM performance remain high as long as methane is in excess with respect to CO₂. At 800°C, CO₂/CH₄ ratio up to 0.8 may be used, whereas at 600°C, CO₂/CH₄ should be kept below 0.4. These results allow considering direct biogas reforming in looping conditions. For shale gas valorization, the reactivity of ethane in CLDR conditions is explored. In all the explored temperature range, ethylene formation is observed. Optimization of conversion and selectivity to syngas from ethane reforming should nevertheless be possible by adapting the amount of solid and reaction conditions to the higher oxygen need for ethane reforming in comparison to that of methane.

Keywords:

chemical looping; dry reforming; methane; ethane; biogas; shale-gas

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