Experimental study of catalysts and process designs for chemical synthesis using H_2 and CO_2

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Foteini Lappa [1 2], Michiel Dusselier [1], Grégoire Léonard [2]

[1]Center for Sustainable Catalysis and Engineering, KU Leuven

[2]Faculty of Applied Sciences, Department of Chemical Engineering, ULiège

E-mail address: foteini.lappa@kuleuven.be

INTRODUCTION

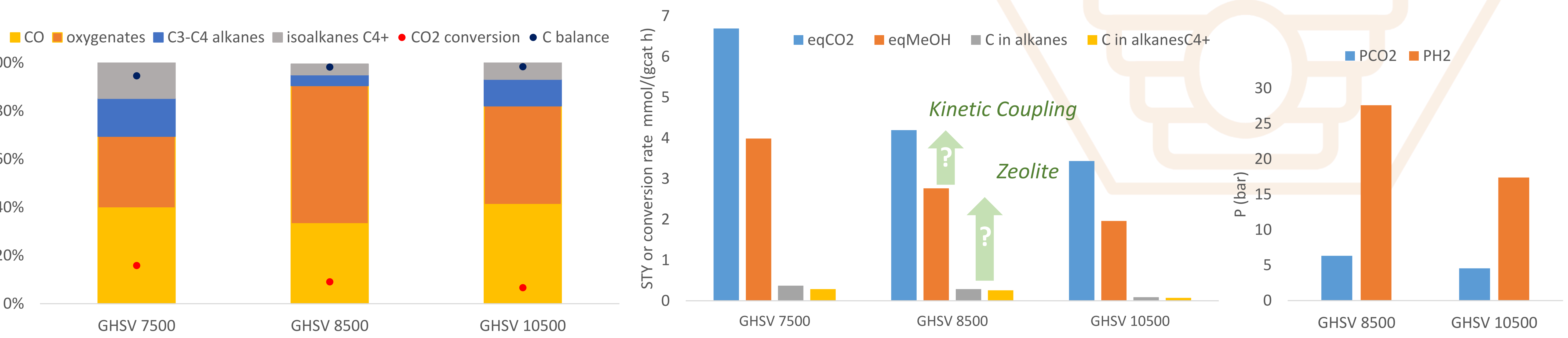
Carbon neutral fuels are getting more and more attractive due to the global warming and energy crisis. The main goal of this project is to produce green added-value fuels (e.g. jet, higher length hydrocarbons) directly from CO_2 and H_2 in a **one-step reaction**.

Until today this process has been studied mainly using syngas (CO/H_2) as a feed and producing hydrocarbons through the Fischer-Tropsch Synthesis route, especially for certain ranges of hydrocarbon numbers(3,5,7).

The idea is to use **CO_2 and H_2 feeds** via methanol as intermediate by combining the CO_2 to methanol process on reducible oxide catalysts with the well-known **Methanol to Hydrocarbons** chemistry. The latter will be modified through new catalyst development to selectively produce gasoline-range hydrocarbons.

$CO_2 + H_2$ —(Metal oxide catalyst)→ MeOH —(Zeolite)→ HCs

PRELIMINARY RESULTS



Effect of different Gas Hourly Space Velocities (ml/gcat/h) on (a) product distribution, conversion and carbon balance, (b) space time yields of equivalent CO2 and MeOH and alkanes produced, (c) partial pressure or reactants

Fixed bed reactor, Catalyst: InCo + BEA Si/Al 19 (1:1) mixed bed configuration, T = 300°C, P = 40 bar, $GHSV_{CO2}$ = 1500 $ml_{CO2}\ g_{cat}^{-1}\ h^{-1}$

OBJECTIVES

- Development of new catalytic materials(1,2,4,8) and large-pores zeolites (6)
- Catalyst screening, esp. zeolites not tested for MTH in high CO_2 pressures / H_2 environments
- Target in high C4+ selectivity (at high C balances)
- Scale up for best materials in semi-pilot scale reactor
- Study and optimize process conditions

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