LABORATORY FOR CHEMICAL TECHNOLOGY
Technologiepark 125, 9052 Gent, Belgium

Coach	**Supervisor(s)**	**Funding**
ir. Sébastien Siradze ir. Maria Herrero Manzano	prof. dr. ir. Joris Thybaut, dr. ir. Jeroen Poissonnier	-

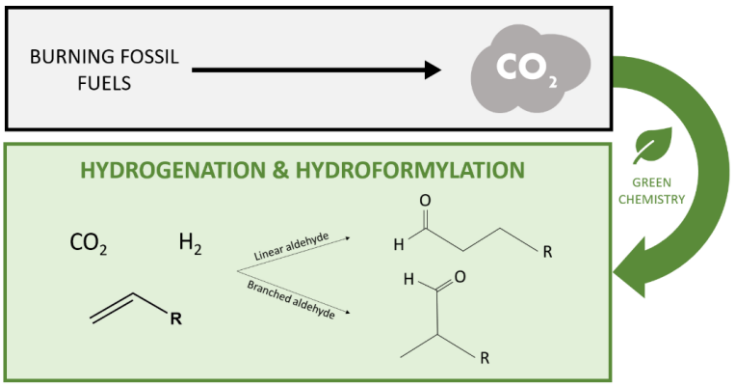
Experimental investigation of ethylene hydroformylation with CO_2 using a bifunctional gold/rhodium catalyst

Aim

Assess the viability of performing ethylene hydroformylation using CO_2 as a reactant instead of CO. A gold/rhodium-based catalyst will be synthesized which can catalyze the reverse water-gas shift of CO_2 to CO and the hydroformylation of ethylene to propanal. To investigate the reaction, experimental work will be carried out in a fixed-bed reactor with the synthesized catalyst.

Justification

Hydroformylation is performed on a large scale in industry to obtain aldehydes from alkenes. During the reaction, an aldehyde group coming from a syngas mixture (CO and H_2) is added to the double bond of the olefin producing chains which are longer by one carbon atom. As a more renewable alternative, CO_2 could be used instead of CO as a reactant. Rh catalysts are known to be active for ethylene hydroformylation to propanal at mild temperatures around 100 °C [1], but are not as active for the reverse water-gas shift of CO_2 to CO at the considered temperatures. For this reason, gold nanoparticles could be added to the catalyst to catalyze the latter reaction at similar temperatures, leading to a more sustainable hydroformylation. The goal of this thesis is to investigate the feasibility of ethylene hydroformylation with CO_2 as a reactant using a bifunctional heterogeneous catalyst.



Program

1. Literature survey on rhodium and gold catalysts for hydroformylation and reverse water-gas shift
2. Synthesis and characterization of a heterogeneous catalyst containing gold and rhodium nanoparticles
3. High-throughput kinetic investigation, experimental campaign of heterogeneous hydroformylation of ethylene using CO_2 and hydrogen as the gas feed mixture.

1. Navidi, N., G.B. Marin, and J.W. Thybaut, *A Single-Event Microkinetic model for ethylene hydroformylation to propanal on Rh and Co based catalysts.* Applied Catalysis A: General, 2016. **524**: p. 32-44.

GHENT UNIVERSITY
LCT DRIVING CHEMICAL TECHNOLOGY