

<b>Coach</b> Yonggang Cheng	<b>Supervisor(s)</b> Joris Thybaut	<b>Funding</b> EU commission: C123
--------------------------------	---------------------------------------	---------------------------------------

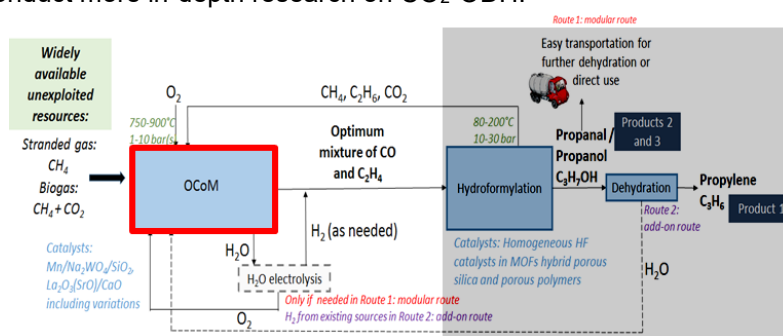
## CO<sub>2</sub> assisted Oxidative Dehydrogenation of Ethane: experimental investigation and preliminary kinetic modelling

### Aim

To investigate the reaction behaviours of CO<sub>2</sub> assisted Oxidative Dehydrogenation of Ethane (CO<sub>2</sub>-ODH) via experiments. Moreover, to clarify the reaction mechanism and to preliminarily build the microkinetic model based on the experimental observations.

### Justification

Oxidative conversion of methane (OCoM)<sup>1</sup> is a novel process that is aimed at obtaining gas mixture with optimal ratio of CO/C<sub>2</sub>H<sub>4</sub>. As one of the most critical processes in C123, it is of great importance and interest to figure out its reaction mechanism and to establish the corresponding kinetic model that can be further applied in catalyst design, reactor design or process optimization. OCoM is designed as a complex reaction system composed of oxidative coupling of methane (OCM), post bed cracking (PBC), CO<sub>2</sub> assisted oxidative dehydrogenation of ethane (CO<sub>2</sub>-ODH), etc. Among all the reactions, CO<sub>2</sub> ODH is expected to play a critical role in adjusting the ratio between CO and C<sub>2</sub>H<sub>4</sub> which are products of OCM. Currently, although works<sup>2</sup> regarding to this reaction have been reported, the reaction mechanism and more importantly the relevant kinetic modeling have not been deeply investigated yet. Therefore, it is meaningful to conduct more in-depth research on CO<sub>2</sub>-ODH.



### Program

As the first step, the fundamental knowledge of OCM, ODH as well CO<sub>2</sub>-ODH needs to be thoroughly studied through literature survey. The experiments will be performed over self-prepared catalyst in wide ranges in order to observe the reaction performances in various conditions. A dataset will be constructed based on the experimental results for further kinetic model construction.

### Reference

1. Dubois, J.-L., Nieder-Heitmann, M., Letoffet, A. & Vleeming, H. C123-Methane Oxidative Conversion and Hydroformylation to Propylene: Raw material sources and market analyses of the modular route C3 products. *Johnson Matthey Technol. Rev.* **65**, 301–310 (2021).
2. Wang, S., Murata, K., Hayakawa, T., Hamakawa, S. & Suzuki, K. *Dehydrogenation of ethane with carbon dioxide over supported chromium oxide catalysts. Applied Catalysis A: General* vol. 196 (2000).