C123: Valorizing Methane Resources into C3 Building Blocks

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C123 ZEOCAT-3D BIZEOLCAT
joint webinar
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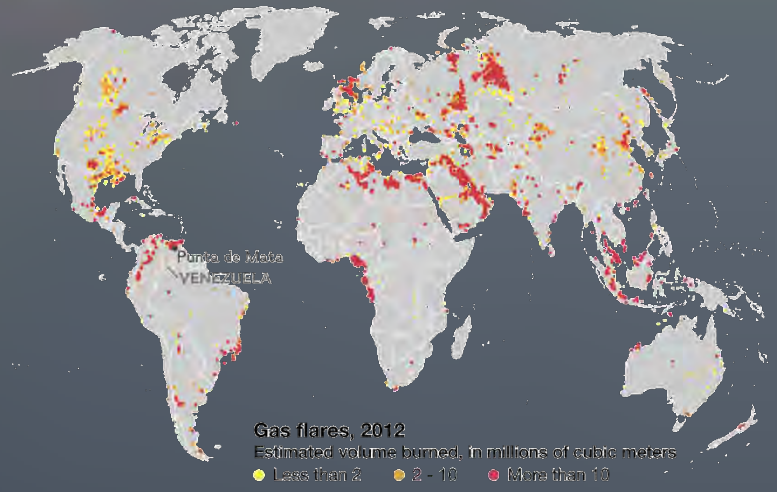
EU-project Horizon 2020 GA No. 814557 C123 Methane oxidative conversion and hydroformylation to propylene

today's reality…



...requires immediate solutions!

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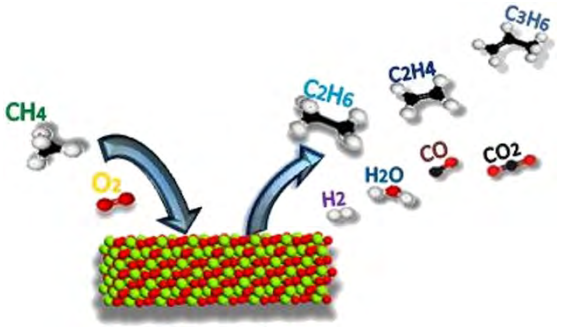
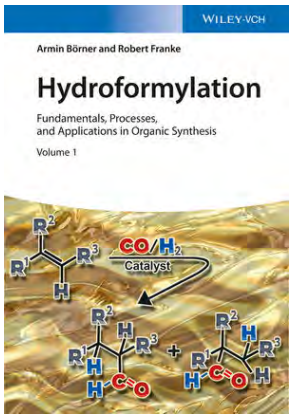
VALORISING METHANE RESOURCES



Noon et al. J. Nat. Gas Sci. Eng. 18 (2014) 406

- **methane oxidative conversion (OCoM)** into ethylene, CO and H_2
- followed by **hydroformylation to propanal**



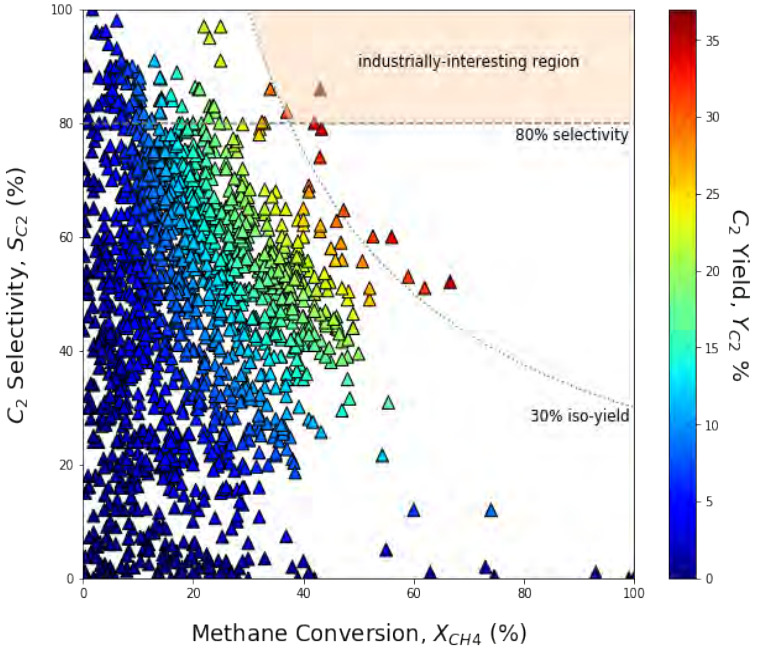
Börner and Franke, Wiley, 2016

C123 Methane oxidative conversion and hydroformylation to propylene

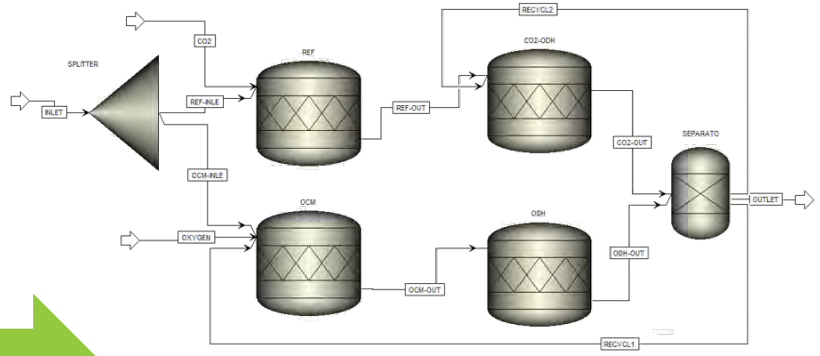
- feedstock: natural gas/associated gas/biogas (methane and CO_2)
- targeted product: easily transportable/high-value chemical (propanal, propanol, propylene)
- add-on vs modular route

Oxidative Conversion of Methane (OCoM)

- Oxidative Coupling of Methane (OCM)
  - decades of research
  - entire periodic table as potential catalyst
  - awaiting successful commercialization



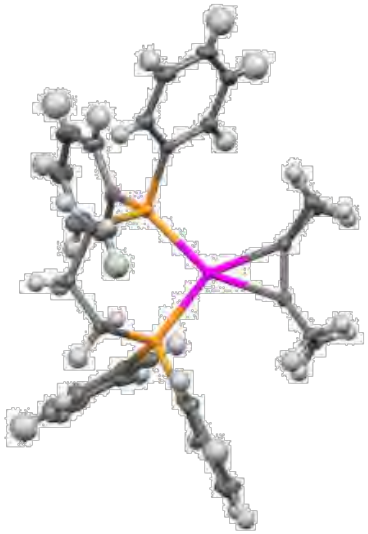
Pirro et al. Reac. Chem. Eng. 5 (2020) 584

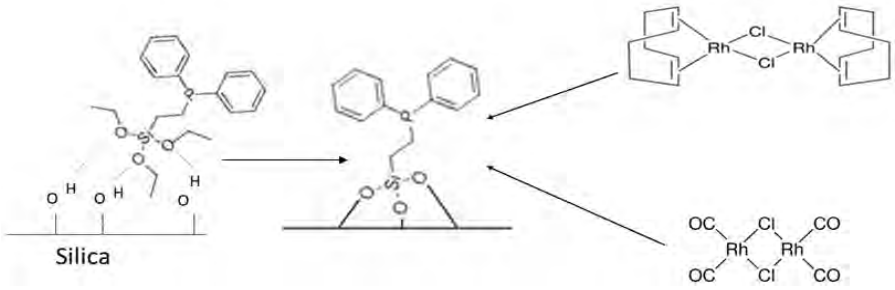


- hydroformylation feedstock production
  - save on separation
  - enhance atom efficiency
  - incorporate CO_2
  - easily liquefiable product

ethylene hydroformylation

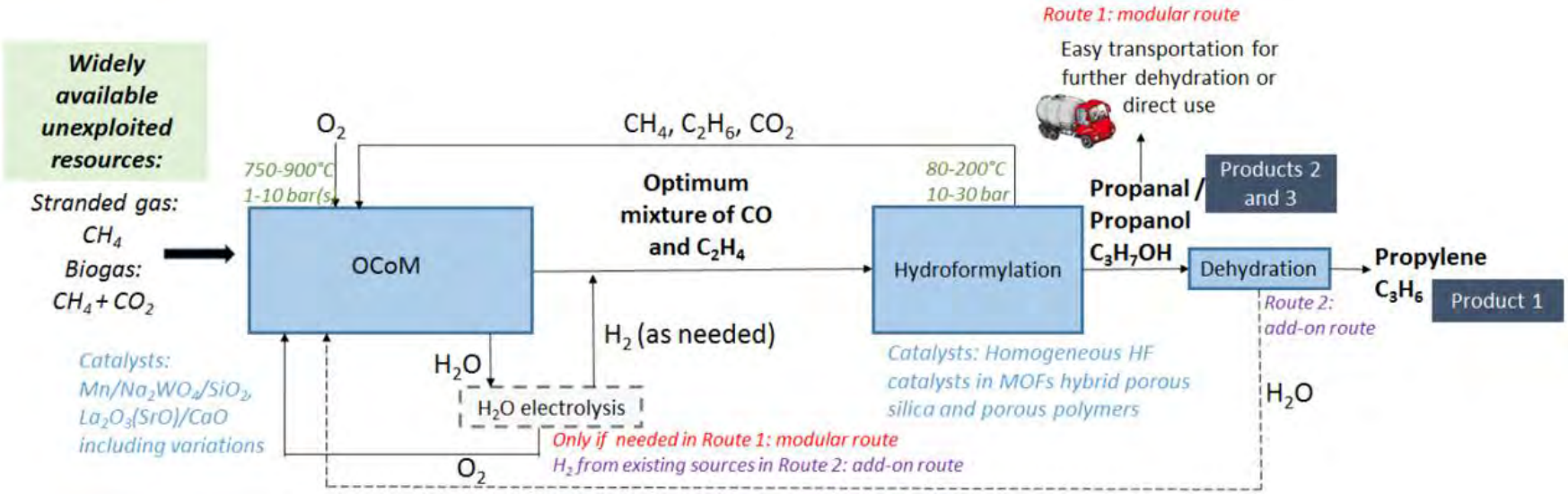
- homogeneous catalysis
  - Rh or Co complexes
  - high pressure
  - liquid phase





- heterogeneous catalysis
  - grafting phosphine ligand on silica support
  - rhodium coordination complexes
  - tethered hydroformylation catalyst

C123 process development and integration, techno-economical development and life cycle analysis



conclusions

- methane transformation towards easily transportable/high added value chemicals holds significant promise
- challenges:
  - ethylene/hydroformylation feedstock production from methane
  - matching methane conversion and hydroformylation operating conditions
    - heterogenizing hydroformylation reaction
    - process development and integration

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VALORISING METHANE RESOURCES

- C123
  - 6.5 M€ (EU contribution) project, coordinated by SINTEF (Richard Heyn)
  - 01/2019 -> 02/2023

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Thank you for your attention!