The CARENA project

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Scale-up of Palladium Membrane Technology
From Fundamental Understanding to Pilot Demonstration
Petten, November 20 & 21, 2014
• Need to turn to novel feeds such as light alkanes (C1 – C4), coal and biomass
• But ...light alkanes are difficult to activate and transform directly and selectively to added value products

Increasing dependence on oil
CARENA Project objective

• Develop catalytic membrane reactors
  – For the efficient conversion of light alkanes and CO\textsubscript{2} into higher value chemicals
  – Resulting in the reduction of the number of process steps
  – And an increase in feedstock flexibility for the European chemical industry
Membrane development within CARENA
Membrane types

- OCM
- Direct MeOH
- MeOH
- H₂O
- DMC
- CARENA Membranes
- O₂
- H₂
- H₂ / syngas
- PDH
Membrane development within CARENA

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CARENA Membranes

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2nd Pd membrane scale-up Workshop
Challenges

Material science
Defect free and homogeneous membranes
Scale-up with reproducible results
Improving membrane resistance to temperature and thermal fatigue
Inexpensive sealing
Membrane & catalysts resistant to poisoning and coking
Catalyst performing in wide operating window
...

Chemical engineering
Understanding and modeling transport phenomena
Design for heat supply and temperature-control in large-scale modules
Alternatives to large sweep streams
Criteria for optimal choice of membrane reactors
Designing compact reactors
...

Based on:
Current hurdles to the success of high temperature membrane reactors, G. Saracco, G.F. Versteeg, W.P.M. van Swaaij, Journal of Membrane Science 95 (1994), 105-123
CARENA Pd membrane reactors
Pilot/Prototype-scale demonstration

Integrated concept

Non-integrated concept (KT)
CARENA Pd membrane reactors

Integrated concept

Non-integrated concept (KT)

Module design

Catalyst development

Application requirements

Understanding Lifetime effects

Scale-up fabrication
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Visit our website at:
www.CarenaFP7.eu

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