

Call FP7-NMP-2010-LARGE-4: PROJECT PROPOSAL in negotiation phase

For the FP7-NMP-2010-LARGE-4 Call the CARENA consortium submitted to the EC a proposal for a large European collaborative project to promote the implementation of catalytic membrane reactors in the European chemical industry. The proposal was highly recommended by the evaluators and is currently in the negotiation phase. The focus of CARENA is on creating technologies enabling efficient conversion of light alkanes and CO₂ into higher value chemicals. Progress in materials, design of nano-architectures and technical membrane reactors will enable the development of these novel processes. CARENA brings together a strong European consortium with top level universities, R&D centres, industrial technology providers, chemical producers and innovative SME's to address both scientific and technological challenges.

New C1-C4 value chains

In the past decade the world has experienced a widening gap between the predicted future demand for oil and known reserves fuelled particularly by the growth of new economies like China and India. High oil price may particularly affect the competitiveness of the chemical industry in Europe, which relies on more than 70% imports for its oil needs. In a global environment with higher cost of naphtha from crude oil and higher cost of CO₂, the chemical industry may need to turn to novel feeds such as natural gas, coal and biomass to stay competitive. Technologies that are able to use as feedstocks light alkanes (C1 – C4) and CO₂ rather than long-chain hydrocarbons from oil will be needed. However, light alkanes and CO₂ are stable molecules that are difficult to activate and transform directly and selectively to added value products. Radical scientific and technological improvements are thus required to enable efficient and competitive routes for their use.

Membrane reactors

Process Intensification plays a crucial role in overcoming these challenges. Development of catalytic membrane reactors opens new pathways for materials chemistry and processes, as recently reported by the European Platform for Sustainable chemical industry (SusChem). According to the European Roadmap Process Intensification published in 2008 and based on the contribution of more than 50 international experts in the field, membrane reactors are one of the leading process intensification technologies. Well known examples are reactors using selective membranes to remove one reactant from the reaction medium and non-selective membrane reactors, which supply reactants in a regulated way or create a well defined reaction interface.



Catalytic REactors based on New mAterials (CARENA)

Focus of the CARENA project

CARENA develops technologies for the conversion of selected light alkanes, such as methane and propane, as well as CO₂ into valuable chemicals. Processes have been selected to create the largest potential impact by targeting major based chemicals, such as ethylene, propylene and methanol, as well as direct routes to highly functionalized chemicals.

The objectives of the CARENA project are to develop and implement novel nano-structured materials and optimized membrane-reactor based chemical processes.

The main benefits to the chemical industry in Europe are to:

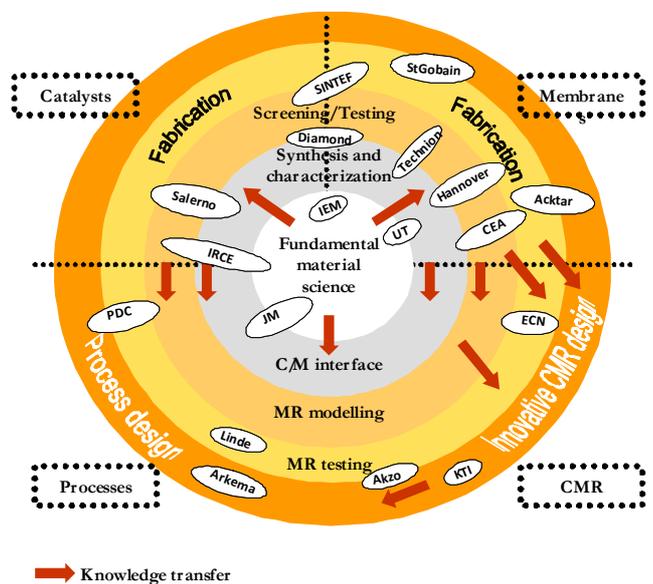
- Create new possibilities for the use of cheaper, less reactive raw materials.
- Reduce environmental impact, energy and raw materials consumption by increasing process selectivity, creating innovative process flow schemes and reducing the number of process steps.
- Reduced process risks due to the use of these new and/or more efficiently integrated processes.

The consortium

To achieve competitiveness and sustainability of new chemical processes through the development of highly innovative nano-structured materials and optimized membrane-reactors, scientific excellence needs to be combined with industrial know-how of leading businesses. CARENA brings together companies and institutes from 8 European countries. European chemical companies as **AkzoNobel** and **Arkema** ensure a strong industrial leadership to the project. Technology providers and developers include **Johnson Matthey**, **StGobain**, **Technip KTI**, **Linde**, **Acktar** and **PDC**. Scientific excellence is strengthened with top-level academic partners and research institutes: **CEA**, **ECN**, **SINTEF**, **CNRS-IEM**, **CNRS-IRCE**, **Diamond**, **Technion**, **Universities of Salerno**, **Twente** and **Hannover**.

Key features of the proposal

- **Application driven:** Industrial partners have led the selection of chemical processes and added-value products to be developed.
- Advances in **nano-structured materials** drive the development of innovative processes. Progress beyond state-of-the-art will be achieved to:
 - Develop novel *membrane materials* with improved performance and lifetime.
 - Design new *catalyst/membrane interfaces* using multi-scale approaches.
- **Balanced portfolio:** A mix of short-term and long term R&D perspectives:
 - *Short term* focussing on accelerating implementation in defined areas.
 - *Long term* innovative research aiming at breakthrough concepts.
- **Multidisciplinary competences:** Partners bring in core expertise in wide range of relevant areas:
 - Materials synthesis and fabrication
 - Characterisation
 - Modelling
 - Reactor design
 - Process design, intensification and engineering & system integration



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