Newsletter – Issue 3 – November 2012

Editorial

From the Coordinator …

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Within the CARENA project we achieved a milestone I am especially proud of. In the first half of 2012 ECN successfully started up a fully integrated (5 Nm3/h) membrane reactor for hydrogen production. Having been closely involved in the project I may not be an objective observer. But there is good reason to draw attention to this achievement .

The reactor concept breaks away from the idea that a membrane reactor should be built as a repeating number of elements containing catalyst, membrane and heat transfer. This touches on an important "motif" of the CARENA project. The idea that the interplay between membranes, the catalyst and the reactor design is one of the keys to technological breakthroughs. Of course if the challenge is understanding how to bring all these technical and scientific elements together, the greater challenge is to bring all these ideas and partners together and bring open innovation to life. Therefore the start-up of equipment such as the hydrogen membrane reactor, integrating knowledge and know-how from many directions, is a mayor event for the project. More soon to follow!

Arend de Groot

What is CARENA ?

The 1st of June 2011 marked the start of the **CARENA** project: **Catalytic Reactors based on New Materials for C1-C4 valorization.** It is an EU-funded collaborative project to create technologies enabling efficient conversion of light alkanes and CO_2 into higher value chemicals. To reduce the dependency of the European community on imported oil, the CARENA project will promote the implementation of catalytic membrane reactors in the European chemical industry.

Collaborative Project: Large-scale integrating project
FP7-NMP-2010-LARGE-4
48 months - Start day : 1st June 2011

www.carenafp7.eu

CARENA gather 19 partners with high level of expertise in their fields all over Europe

CARENA in progress

1- Joint Workshop on Palladium Membrane Technology Scale-Up 12-14 November 2012. Rome, ITALY

The Cachet, Comethy II & CARENA projects co-organized a joint workshop on **Pd Membrane Technology Scale-Up** - in **Rome, ITALY** on **12-14 November 2012**. It was held at the Visconti Palace Hotel.

A Site tour to Tecnimont KT membrane reforming pilot plant at Chieti was organized on the 2nd day of the workshop.

This event covered a good breadth of topics that are critical for Pd membrane technology scale-up: from the fundamentals of palladium membrane, support and seal manufacturing, to various concepts of membrane module design and system integration; from lab-scale long-term stability testing results to industrial pilot plant operational insights.

The workshop was successful, with interesting presentations and fruitful discussions.

Over 70 participants were present from industry sectors as well as research institutes and academia.

Presentations, photos and more information will be available soon on the 3 project's websites.

A combined document reporting the workshop will be available on January 2013. it will contain a summary of each sessions and include some pictures taken from the workshop and Chieti visit.

The brochure and program : Annexe

CACHET-II is an EC FP7-funded project with a total budget of €5.2m, conducted by an 8-member consortium of leading research institutes, universities, energy businesses and engineering companies. It is coordinated by BP, aiming to develop innovative membrane technology to increase the energy efficiency of pre-combustion CO2 capture in natural gas- and coal-fired power plants.

http://www.cachet2.eu/

The COMETHY project is a collaborative project co-funded by the Fuel Cells and Hydrogen Joint Undertaking with a total budget of ca. 4.9 M€. The project is conducted by 12 organizations coordinated by ENEA (Italy). The general objective is to develop a compact & fuel-flexible membrane reformer for hydrogen production, adaptable to different heat sources.

http://www.comethy.enea.it

2 - Review of the Current State

In the day-to-day CARENA work one really experiences the project gaining momentum. Many subtasks and deliverables have been completed or are close to being finalized. Researchers reach very interesting results and can't wait to share and publish the results.

Sharing results with the outside world is an ambition, which is natural to researchers and also one of the objectives of the European Commission. At the same time, the Seventh Framework Programme (FP7) – under which CARENA falls – defines an additional focus area of protecting valuable results, so-called *Foreground*. In the rules for participation and in the Grant Agreement it says: *"Valuable foreground should be protected."* and *"Each participant shall ensure that the foreground it owns is disseminated as swiftly as possible. However, any dissemination should be delayed until a decision about its possible protection has been made (through IPR or trade secrets)."*

In the CARENA project we should find a good balance between the two ambitions. On the one hand we have to recognize the protection and exploitation of valuable Intellectual Property (IP), but on the other hand we should not unnecessarily withhold researchers from publishing their very interesting new findings.

To cover this issue we have created an IPR Strategy report, which defines the strategy to maximize the generation of IP as well as procedures to monitor and protect it. Key areas of interest are recorded in an overview document such that we all know where we expect to generate new IP and what actions are to be taken. In the meantime, proposed publications are reviewed and in a number of cases a further investigation is made to the need and interest of partners to protect valuable results.

Now we have reached month 18 at which point in time we will issue the first periodic report, there are many signs indicating that the CARENA project is on the right track. The individual work packages report that the work proceeds according to plan, while efforts to solve any deviations are clearly prioritized. Many highlights are reported. To name three examples: ECN completed the first phase pilot membrane reactor testing for methane reforming successfully; new composite membranes were developed by Twente University for separating water from complex process mixtures, IRCE-Lyon and Diamond analyzed mixed oxide materials in an advanced cell for in-situ characterization at high temperature using synchrotron X-ray absorption spectroscopy (XAS), X-ray powder diffraction (XRD) and mass spectrometry (MS).

***CARENA's team during the 1st annual meeting - 29-30* May -Lyon, France.**

3- Interview of CARENA partner: Gerhard Remmers, AkzoNobel. The Netherlands.

Gerhard Remmers is Innovation Technologist at AkzoNobel Industrial Chemicals since 2011.

AkzoNobel is the largest global paints and coatings company and a leading producer of specialty chemicals.

What made you opt for a scientific career? How would you define your job?

Well, I started as a process engineer in AkzoNobel - a job which is more day-to-day, a plant is build to produce and to make money. If a process or something else in production fails solutions have to be found on the short run. When a continuous plant is running 24/7 as planned then potential plant optimizations are to be elaborated. The scope of a process engineer is the plant. I learned a lot about technology in practice in these days.
In research the subjects are far less day to day driven, they have a wider and deeper scope and a much longer timeline. There is much more variety in subjects resp. projects. This is more attractive to me.
Nowadays I'm working as an Innovation Technologist at AkzoNobel Industrial Chemicals in Amersfoort. This job is really challenging to me as we try to have 'a look out of the box' and find new connections and extensions to our existing businesses on a mid to long term basis. Our participation in CARENA WP3 concerning Methanol/DME and DMC is a good example for this. Which also means open innovation: working with (inter)national partners belongs to the nicest aspects of my work these days!

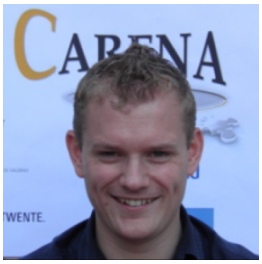
How does membrane chemistry fit in the pattern? Would you say chemistry is going through major changes?

Sustainable development and environment issues are indeed key concerns nowadays. Membrane chemistry might fit well in this, unfortunately it is not an 'all mighty solution' when process conditions (e.g. P,T) are too severe…
Although in membrane electrolysis of NaCl we have seen substantial membrane improvements through the years!
Chemistry will go through major changes in the coming years. Renewable raw materials will increasingly be used and old and forgotten uneconomic processes will be actualized in order to compete with oil based chemistry. So it's going to be tough…!

Thank you Gerhard, and all the best for CARENA

Read the full interview online
http://www.carenafp7.eu/index.php/Interviews/Interviews.html

4- Overview : PhD and Post doc about their work subject : Harro Mengers– University of Twente. The Netherlands



PhD student from the Netherlands. After my high school I went to the University of Twente where I did my Bachelor in Chemical engineering. After my Bachelor I continued at the same university with the Master Process technology, which I finished in 2010.

How did you meet the Prof. Nijmeijer's team?

In the Netherlands we finish our Bachelor and Master with a final assignment. For my Bachelor I worked on membrane contactors and in my Master I worked on membrane electrodialysis. Both assignments I performed in the group of Kitty Nijmeijer and since she was my final supervisor I got in contact with her.

UNIVERSITY OF TWENTE.

What do you expect from this PhD?

As mentioned before, my background is in process technology and therefore it interests me how products are developed from scratch to application. Research is the first step in this process. During my PhD my goal is to go through different development steps and to learn as much as possible from each step so I can and to use this knowledge in the future.

Thank you Harro for giving us a glimpse into your progress with research activities!

Read the full interview online
https://www.carenafp7.eu/index.php/Interviews/Interviews.html

5- Next joint Workshop Demcamer & CARENA 30 January 2013. The Netherlands

The Demcamer & CARENA EU-FP7 are the two large scale projects which have been selected and funded under the same call. They will co-organize a joint workshop on membrane reactors. It would be held at Eindhoven University on 30th January 2013.

It will consist in a meeting of PhDs and senior researchers of both projects.

Program

8:45-9:15 - Coffee and Introduction to the meeting
9:15-9:30 - Introduction CARENA
9:30-9:45 - Introduction Demcamer (Pablo)
9:45 - 10:25 - Lecture on catalyst preparation
10:25 - 10:45 - Coffee break
10:45 - 11:25 - Lecture on Membrane reactors for CO2 utilization
11:25 - 12:05 - Modeling of membrane reactors
12:05 - 12 :45 - Membrane preparation
12:50 - 14:00 - Lunch
14:00 -16:30 - Poster parade and coffee
16:30 - 17:00 - Final remarks and closure of the meeting

*The **DEMCAMER** is a Large scale collaborative project funded under FP7 Cooperation Specific Programme and Nanotechnologies, Materials and Processes NMP Theme. The Project has started the 1st of July of 2011 and it will last for 48 months. It is conducted by 18 Partners and coordianted by Tecnalia.*

The aim of DEMCAMER project is to develop innovative multifunctional Catalytic Membrane Reactors (CMR) based on new nano-architectured catalysts and selective membranes materials to improve their performance, cost effectiveness (i.e.; reducing the number of steps) and sustainability (lower environmental impact and use of new raw materials) over four selected chemical processes ((Autothermal Reforming (ATR), Fischer-Tropsch (FTS), Water Gas Shift (WGS), and Oxidative Coupling of Methane (OCM)) for pure hydrogen, liquid hydrocarbons and ethylene production.

http://www.demcamer.org

6- Participation of CARENA's Students to national & international events

The PhDs and senior researchers are active and participate to several national and international events in order to communicate the CARENA's results. Please find more details via this link :

http://www.carenafp7.eu/index.php/Publications/Publications.html

Miscellaneous

❖ A few dates :

- **9th European Conference of Chemical Engineering (ECCE9) and the 2nd European Conference of Applied Biotechnology (ECAB2)**

The Hague- The Netherlands, 21-24 April 2013 www.ecce2013.eu

A special cluster is forecast for both CARENA & Demcamer projects around "catalytic membrane reactors"

- **23rd NAMS Meeting, NAMS**

Noise (ID) - U.S.A., 8 – 12 June 2013 jerry.lin@asu.edu

- **13th Conference of the European Ceramic Society**

Limoges-France, 23-27 June 2013. http://www.ecers2013.fr/

A special session (E) will be dedicated to "Ceramics and systems for energy and environment"

- **11th International Conference on Catalysis in Membrane Reactors (ICCMR11)**

Porto- Portugal, July2013 http://www.iccmr11.spq.pt/eventos/iccmr11/

- **9th World Congress of Chemical Engineering NCCE-9**

Seoul-S. Korea, 18-23 August 2013 http://wcce9.org

- **XIth European Congress on Catalysis "20 years of European Catalysis...and beyond" (EuropaCatLyon 2013)**

Lyon- France, 1-6 September 2013 http://www.europacatlyon2013.fr/en/home.html

- **ICOSCAR-4 4th International Conference on STRUCTURED CATALYSTS AND REACTORS**

Beijing- China, 25-27 September 2013 http://www.icoscar4.com

- **International Conference on Membranes, ICOM**

Suzhou - China, 20 -25 July 2014

❖ About Suschem and reaction/process design:

Suschem thinking has inspired a large number of FP7 projects on reaction and process design from process intensification to a wide range of catalytic studies.. Why not to push new ideas based on the use of membranes ?

To feed your inspiration please look at : http://www.suschem.org/priorities/enabling-technologies/reaction-and-process-design.aspx

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