



CAlytic membrane **RE**actors
based on
New mAterials for C1-C4 valorization

CARENA is a large-scale integrating project funded by the EC

**Interview with Michiel Raaijmakers –
Twente University, The Netherlands.**



I studied Chemical Engineering at the University of Twente (Netherlands).

During my studies I did a BSc. assignment on water treatment at University of Barcelona (Spain), an internship at Vaperma (Canada) on the influence of process conditions on a pilot scale membrane unit performance and a MSc. Assignment at the University of Twente on the production of stainless-steel porous hollow fibers. I wanted to expand my knowledge on membrane-related systems by doing a PhD project. The CARENA project gave me the opportunity to work on membrane materials, while staying in touch with relevant large-scale processes within the rest of the project. Moreover, the European context allowed me to get acquainted with many researchers in a cooperative environment.

What is your PhD project about? What objectives do you have to reach?

My project focusses on the development of novel membrane materials for gas and vapor separations at elevated temperatures and pressures. Within this framework, I have been developing a method that allows for the synthesis of large-

scale defect-free membranes that consist of inorganic-organic hybrid network materials. The main objectives of the study are to define the critical parameters in membrane synthesis, to determine how we can tune the network characteristics, and to show how the membranes function under relevant process conditions.

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*What is the best thing about taking a PhD?
How challenging is it?*

Doing a PhD allows you to create completely new concepts. This involves devising creative new ideas and smart collaborations with colleagues in different institutions. By gaining new insights, you are constantly required to adjust the direction of your research. Maintaining control over the evolution of your project is maybe the most challenging, but this also makes it rewarding.

What did you learn from your participation to national/international events during your PhD?

I got acquainted with many colleagues from institutions and companies. I learned what the different interests and goals are of most parties and how bringing together these different viewpoints can support advances along the line.

Do you have some advice to master/engineer students considering taking a PhD?

A PhD is challenging on many levels. You have to be able to manage a project that lasts several years, without knowing the development of your research beforehand. You have to involve a wide spectrum of experts from different fields to strengthen your own competences. And most of all, you have to be very motivated to bring success to the project. I would advise anyone considering a PhD to think about their reasons, development goals and expectations. Talk to others (PhDs, postdocs, professors) about these aspects before you make the decision. Doing a PhD and the development you go through are definitely worthwhile, but you have to make it work.

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What is appealing to you being a researcher?

You are constantly developing yourself at many different levels. As a researcher, Lifelong Learning is a central aspect. If you do it right, you are part of an assembly of experts that strengthen each other's competences. You learn how to steer a project, collaborate – even if the stakes of other parties are not the same – and how to build expert knowledge. Definitely, you strengthen your ability to critically analyze situations, anticipate outcomes and deal with unexpected situations.

Do you have any plans after completing the PhD?

There are many options available within academia and industry to continue with materials and process research. I aim to further expand my research competences, not necessarily limited to membrane science. How this will take shape I still have to decide.

CARENA in brief

Starting date: 1st June 2011
Project duration: 2011 – 2015
Number of partners: 19
Coordinator: Arend de Groot, ECN, the Netherlands
Programme: FP7-NMP-2010-LARGE-4
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Thank you Michiel for answering my questions, and all the best for your CARENA project.

Interviewed by Laurence Bosch

