CARENA

CAtalytic membrane REactors based on New mAterials for C1-C4 valorization

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

Interview with Moshe Sheintuch Technion. Israel

Can you give us some background information about your education and current research?

I hold a BSc degree from the Technion and a PhD degree from University of Illinois. Between the two I worked for a brief period for the government as an Environmental Eng. When I searched for a PhD advisor at U of I, I looked for an environmental project, and was offered a topic on "Oscillations during catalytic CO oxidation". That turned out to be a great topic even though it had little to do with environmental technology: It was a novel topic, it introduced me to non-linear dynamics- an emerging field at the time, and to reaction engineering. Most of my research in subsequent years was devoted to dynamics of catalytic reactors, unveiling new behaviors like chaos, pattern formation, using new mathematical tools like bifurcation theory and discussing their implications.

Moshe Sheintuch Technion. Israel

My environmental eng. education, led me to the area of catalytic abatement of water pollutants, and to realize it may have great technological potential. We have developed two catalytic processes, removal of nitrates by hydrodenitrification (currently in its 2nd year as an incubator project, see http://welltodo.co.il/index.html) and catalytic regeneration of activated carbon.

My interest in membrane reactors emerged when I spend a summer in Mobil Central Research Lab. in Princeton NJ. I studied the DH of isobutene and of propane in a self-supported Pd/Rh membrane reactor. The former went well but the latter led to fast deactivation.

Technion is a technical university built in 1925 in Haifa, Israel. It offers programmes in engineering, exact and life sciences and includes a medical school.

Technion's group participating in CARENA:

The **Environmental Catalysis and Reaction Engineering Group** is part of the Chemical engineering Department. Current interests within the group include experimental, theoretical and computational work on problems like spatiotemporal catalytic patterns, reactors with heat recuperation, membrane reactors, hydrogen generation, computational catalysis, reactor control and catalytic abatement of water pollutants.

Read more on page 2.

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

I owe my curiosity in chemistry to my high school chemistry teacher. The interest in science emerged during my PhD studies, which allowed me to work on the border of science and technology, as I still try to do.
Teaching, research and administrative work are the three main tasks of a faculty member; you have the liberty to choose your topics of research. I tried to work at the boundary between science and technology: topics that are of commercial significance, and using new scientific concepts: pattern formation on catalytic surfaces; fractal structures to describe pore volume; DFT to predict adsorption and reaction.

What is the added-value of an EU project such as CARENA compared with other partnerships on the same topic you may be involved in?

Building a MR requires at least three elements: catalyst, membrane and a reactor. Working in a group that has the expertise in these three elements allow you to check new ideas by modification of one or several elements. In previous studies of carbon membrane reactor for isobuatne DH and of autothermal methane steam reforming we purchased the catalysts and the membranes and had to accommodate the reactor design. In CARENA we see emerging efforts of modifying the membrane and catalyst to overcome reaction shortcomings (coking).

CARENA brings together Research labs and industry. How do you view research-industry collaboration within the framework of the project?

Such collaboration is great as it allows you to compare various solutions: While previously we worked with one manufacturer of Pd (or Pd/M) membrane, now we are in contact with four (including Sintef, ECN, Acktar). The other aspect is the hope to modify the catalyst and membrane as described above.

Now is the period of preparation of new EU projects – Horizon 2020 – Are you planning to be involved? Are there any collaborations with another CARENA partner?

Too early to tell.

Read more on page 3.

What do you think is the most satisfying part of this project?

The various perspectives on the problem introduced by the partners lead to the definitions of new research questions: Can you use reaction rate expression based on kinetic data from a regular reactor for designing MR, which operates in sub-stoichiometric hydrogen concentration? If not, how do you derive, experimentally or theoretically, such a rate expression or a model? We took initial steps to build a microkinetic model. How can you define the state of the membrane, in order to predict its permeance? Helpful parameters are hydrogen, CO and propylene adsorption, Pd/Ag surface composition. We hope to use TPD to answer such questions.

And the most frustrating part?

Most of my research grants were with no or maybe one partner (usually another faculty). Usually, with no milestones and with me determining the path and the rate. CARENA and COMETHY EU projects, in which I am currently involved, are multi-partner projects with deadlines and deliverables. I have to get students interested to involve them in the project, make sure that the group meets its deadlines and that try to produce publishable work. All these constraints require better definition of the tasks (reports , thesis).

Is there anything else you would like to add to the report of your interview?

Enough said.

Thank you for answering my questions, and all the best for CARENA.

Interviewed by Sadika Guedidi

TECHNION
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CARENA in brief
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