

NanoMemPro newsletter

“Expanding membrane macroscale applications
by exploring nanoscale material properties”



Happy Birthday!

This is the fourth issue of NanoMemPro's news letter and it describes many events, actions, meetings, etc. occurred in the last six months. The most important NanoMemPro fact however is that on 31st of August 2006, NanoMemPro celebrated its 2nd anniversary. Another year of enthusiasm and hard work. And more important: two more years to come. Please have a look at the news letter and see what has been done during the last 6 months and take a glimpse of what will come in the next period.

Achema 2006

Every three years an enormous exhibition fare is held in Frankfurt (Germany): the Achema. During last May's 28th edition of the Achema almost 4000 participants from 50 countries, both from industry and research, in the field of chemical engineering, materials processing, biotechnology and pharmaceutical and food industries were present.

For this five day event almost every hall in the Frankfurter Messe was occupied by stands and large scale displays (total surface: 140.000 m²). Around 200.000 visitors wandered around, discussed with stand holders and listened to lectures often given by people from industry.

Last spring was the first time NanoMemPro was present. Together with other Networks of Excellence (InsidePores and Idecat) an exhibitor stand was manned in the “research and innovation” hall. A poster and flyers describing the NanoMemPro goals and participants were present as well as a NanoMemPro representative to promote the project and interest industries in cooperation. Unfortunately there were not many industrial employees passing the NanoMemPro stand. It was located in the corner of the furthest exhibition hall and not too many industrial visitors found their way into the hall with mostly universities. Approaching possible industrial partners at their own stand,

Info

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Contact

Kitty Nijmeijer
d.c.nijmeijer@utwente.nl
+31 53 489 4185

Layout

Wilbert van de Ven
w.j.c.vandeven@utwente.nl



however, did lead to interesting discussions and possible contacts. This suggests that it could be useful to actively approach industrial partners instead of waiting for them to show up. The Achema 2006 was the perfect place to contact many people working in different fields.



Impressions of Euromembrane 2006



The “Membrane House”

NanoMemPro is creating its legal entity. Setting up the legal status of the consortium is vital for the future existence and development of the network and one of the top priorities for the next period.

The main purpose of this legal entity is:

- To ensure the development in Europe of a coherent and structured system for research, education and technological development in the field of membrane technologies.
- To help people mobility and to participate in the creation of new employment in the above mentioned areas.
- To create a Think Tank profitable to all European stakeholders, specially by encouraging the creation of start-ups, spin-offs and SMEs and by providing means and tools necessary to their development.
- To represent the membrane community and to influence policy making at national and European level, particularly in relation to the European Union

Setting up a European Membrane Strategic Business and Research Agenda (SBRA)

One of the task of NanoMemPro is to prepare a so called Strategic Business and Research Agenda (SBRA), or Roadmap for membranes in Europe. The aim of this SBRA is to bring together European membrane players (both from industry and academia) to identify long term opportunities and ways for innovations.

A European Membrane SBRA will:

- Structure the European R&D on membranes
- Identify business drivers & targets for innovation
- Feature a series of 10 year roadmaps to organize the growth of the fields of application

People involved are NanoMemPro members, engineering companies, membrane producers and membrane

end users

What has already been done?

Thanks to phone interviews with some of you, a first detailed mapping of membrane industrialists' needs has already been performed, from start ups to major firms, through classic and emerging applications (energy, biomedical, contactors, packaging...).

Based on these interviews a brainstorming workshop with European industrialists was organised (Brussels, September 13th 2006) and used to identify and specify the industrialists needs with respect to different area (Membrane materials, Systems, equipments & process and modelling, Fine chemicals, pharmaceuticals and high value products, Food and water treatment, Energy, Highly functionalised membranes: enhanced selectivity and/or reactivity, Norms & regula-

Setting up a European Membrane Master's Degree

One of the ideas of NanoMemPro is to set up a European Master on Membranes. Such a degree will contribute to the dissemination of the scientific information of the Network. It will help to promote the application of nanotechnologies to the field of membrane science. The aim of the Master is also to allow students to prepare for a European co-directed PhD and to train R&D engineers wishing to work in industry in the NanoMemPro field of focus.

A Master consists in 2 years of academic training. In order to guarantee a high level of training and to promote a multicultural environment (which will facilitate the future integration of the student into the European Union) each student will move about during this two-year Master course. The Master courses will thus take place in 3 or 4 different places (one per semester, thus corresponding to no less than 4 universities) throughout Europe and could be completed by an industrial (or lab) research project. The European community provides grants for mobility costs via the Erasmus and Erasmus Mundus programmes.

tions for membrane materials and technologies, Membrane integration, hybrid processes & new operations. In the next step, research institutes and universities will define their dreams with respect to membrane research. This is planned in October/November 2006. The last and probably most difficult step is to merge and combine the industrial needs and the academic dreams. This process is planned to start at the end of the year.

Installation Scientific Council NanoMemPro

Recently the Scientific Council of NanoMemPro was installed. The council consists of four members (see below) and has the delicate duty to:

- Advise the Network on project orientations.
 - Evaluate the programme of work as well as the results obtained.
 - Formulate recommendations.
 - It may be consulted by the Network on any scientific issues.
 - It may make any proposal or transmit any information it deems useful to the Network
- The Scientific Council is composed of external experts recognised for their expertise in the field of the Project. The four members of the Scientific Council are presented below and on the next page.

Prof. Dr. Jean-Claude Charpentier is the ipPresident of the European Federation of Chemical Engineering and was the Director of the Ecole Supérieure de Chimie Physique Electronique de Lyon from 1992 until end 2004. He is a Professor of Chemical Engineering: Multiphase reactors, and Director of Research at the Centre National de la Recherche Scientific (CNRS). He obtained a doctoral degree in chemical engineering (1968) at the University of Nancy (Ecole Nationale Supérieure des Industries Chimique, ENSIC). JC. Charpentier was the creator and head of a research team on multiphase gas-liquid-solid catalytic reactors (1968-1983) and Vice-Director of the Laboratoire des Sciences du Génie Chimique CNRS-ENSIC-Nancy (1979-1983). Prof. Charpentier was Director of ENSIC (1983-1985) and Scientific Director of the Department of Engineering Sciences of CNRS (1985-1992).

He is Editor of the Journal Entropie, of les Techniques de l'Ingénieur, and Associate-Editor of Chemical Engineering Science and of Chemical Engineering Technology. He is a member a various Scientific Institutions : Société Française de Chimie, Société de Chimie Industrielle, Société Française de Génie des Procédés, Académie Européenne, New York Academy of Sciences, Fellow of the American Institute of Chemical Engi-

neers, Honorary Fellow of the Institution of Chemical Engineers (UK). Jean-Claude Charpentier has been the President of the European Federation of Chemical Engineers (2002-2006). JC. Charpentier is Officier de la Légion d'Honneur, Chevalier de l'Ordre National du Mérite, Chevalier du Mérite Agricole and Médaille d'Argent du CNRS.

Prof. Dr. -Ing. Heiner Strathmann studied Chemistry at the University of Darmstadt (Germany) and obtained his Ph.D degree at the same university. He was employed at many different institutes and companies: University of Aachen, Amicon Corp., Lexington, Mass., Forschungsinstitut Berghof GmbH, Fraunhofer Institute for Bioengineering and the University of Stuttgart. From 1992 till 1999 he was professor of the Membrane Technology Group of the University of Twente. Currently he is Emeritus professor at the University of Stuttgart. He was editor of the journal Separation and Purification Technology and he participates in the editorial board of several scientific journals (Journal of Membrane Science, Desalination, Filtrieren und Separieren, Gas Separation and Purification).

He is a Member of the Board of several scientific organizations (Vice-president of the European Membrane Society (till 1998), UNESCO Center

for Membrane Technology, Australia (till 1998), UN-University, Environmental Science, Gwangju, Korea, and he won several awards (Honorary Professor at the Dalian Institute Chemical Physics (1994), Willy Hager Price and Medal in Gold (1998), Honorary Professor at the Dalian Institute Chemical Physics (2005).

Soccorso Nino Gaeta graduated in Chem. Eng. in 1979 at the Polytechnique of Naples, Italy; in 1981 he received a Master of Science in Chem. Eng. at North Carolina State University, N.C., USA. Between 1982 and 1985, after a brief period at North Carolina State University as Research Assistant, he worked at American Can Company, IL, USA as Senior Research Engineer on a fundamental research project relative to injection blow moulding of plastic containers. From 1985 to 2001 he has served as R&D Director and since 1999 as General Manager at SEPAREM S.p.A., Biella, a company manufacturing U.F. and R.O. flat membranes, spiral wound elements, and systems. Since 2002 he has joined GVS S.p.A., Bologna as R&D Manager for New Products. GVS is a company manufacturing various filters for automotive and medical applications, and membrane contactors.

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He has successfully developed various membranes and membrane based products which are currently on the market. He is author of 8 patents and of many publications relative to the industrial application of membranes. He is a member of the Council of the European Membrane Society since 2002, and is member of NAMS, TAU BETA PI, and European Association of Chemical Engineers.

Paul Pex (Energy research Centre of the Netherlands, ECN, Petten, The Netherlands) graduated in 1987 in Materials Science and Engineering at Delft University of Technology. Following this he started at the Energy research Centre of the Netherlands, ECN, to work on ceramics to metals sealing and the mechanical properties of structural ceramics. In 1992 he became project manager "Inorganic Membrane Materials" and became Group Leader "Molecular Separation Technology" in 1997. In this group, which is currently in size 20 full time equivalents, ECN is developing membranes, predominantly inorganic ones but also polymeric ones, and advanced heat integrated distillation for separations in energy conversion systems and energy saving purposes.

Membranes in Solvent Filtration

International Workshop

Leuven, Belgium, 23-24th March 2006

organized by VITO (Flemish Institute of Technology, Belgium) and the KULeuven (Catholic University of Leuven, Belgium)

During the last decades, membrane filtration has found its way to industrial application. Mild water based streams are treated with polymer membranes, while ceramic UF and MF are becoming mature technologies in harsher circumstances. Furthermore, it appears that a lot of solvent based separations, especially in the chemical and pharmaceutical industry, could benefit from solvent resistant membranes. These separations are primarily situated in the range of nanofiltration or pervaporation which has led to a growing activity in the development of solvent resistant polymer and ceramic membranes, especially for nanofiltration. Different products are already commercialized or are in commercialization stage. More and more experience is available with solvent filtrations; experimental observations show that filtration behavior in solvents is much more complex than in water. A thorough understanding of the solvent performance of membranes, both permeability and retention, is essential for a successful application and

implementation in the chemical and pharmaceutical industry. In order to gather all researchers and process engineers active and/or interested in solvent filtration, VITO (Flemish Institute of Technology, Belgium) and the KULeuven (Catholic University of Leuven, Belgium), organized a specific two-days workshop. It gave a good overview of the state-of-the-art knowledge, and of the new developments in this highly changing field, and gave participants the opportunity to exchange ideas and experiences. One afternoon was specifically dedicated to experience with solvent filtration in industry. The workshop was a great success, and attracted about 85 European participants. Half the attendees came from chemical or pharmaceutical industry. Plans are made to organize a second version of this workshop in 2008.

For more information about these workshops, you can contact anita.buekenhoudt@vito.be.

Exchange of people

VITO (Belgium) ⇔ University of Twente (The Netherlands)

Last summer, Kristien De Sitter, PhD student at VITO and KULeuven, visited the Membrane Technology Group of the University of Twente for a period of 3 weeks. The principal goal of this trip was performing some experiments on the high pressure gas permeation set-up.

Kristien is currently finishing her PhD on the preparation and characterization of silica-filled high free volume polymer membranes. Application of

these membranes is the separation of higher hydrocarbons from hydrogen and methane streams. Until this exchange, all the gas separation experiments were performed on the Velterop equipment at VITO, but last months several problems with the equipment occurred. Additionally, the VITO equipment has also its limitations concerning feed pressure and temperature that can be used. The high pressure gas permeation set-up

of the UTwente can offer a solution for all these problems. A second goal of the trip was knowledge exchange and discussion of the results obtained during the PhD. At VITO, Kristien is the only one working on gas separation. The Membrane Technology Group of the University of Twente has a whole team specialized in gas separation. The discussion possibility was therefore a welcome extra benefit of the trip.

High School students working on the Scientific Project: « Objective Sciences » present their results

Successful result for “Objective Sciences” programme. It was closed the 8 of April 2006, with the public presentation of research results by the high school students themselves. Encouraged by these results, all partners of “Objective Science” programme are already preparing 2006-2007 programme. This project is proposed to the high school students in the final year (of age 17 to 18). The students have to form working parties of 2 or 3. They are managed by two of their teachers (physics-chemistry and English) and a scientific advisor (a member of staff in our University or CNRS).

During this year these 28 students have spent some of their free time working in a research laboratory (LGC, CIRIMAT...). Students presented orally their research work the 8 of April 2006 in the IUFM amphitheatre (Toulouse) to an audience



Pierre Aimar and Sylvain Galier with the students that spent sometime in the LGC-CNRS laboratory

made of the final years (their mates), the teachers, the advisors and their families. About 500 people attended this mini event. Membrane scientific

topic treated this year were: sea water demineralisation by electrodialysis and nanofiltration of coloured waste waters.

Sylvain Galier, and Jean François Lahitte

WP3.0 – Mobility: Conferences and Training Course proposal

NanoMemPro's members application to Marie Curie SCF programme has been quite successful. NanoMemCourse has attained a mark of 90/100, getting classed as A with other 34 proposals. This is a great success, as this was the latest call in the 6th FP and about 400 proposals were submitted.

NanoMemCourse has been presented by CNRS, ITM-CNR, UNIZAR, SINTEF, FORTH/ICE-HT and UTwente in behalf of NanoMemPro. Five events will be organised, with five different topics: two basic topics and three membrane applications topics.

The first part of the programme concerns the fundamental knowledge split in 2 training courses

- o EF1: Nanostructured material and membrane synthesis and characterisation will be organised by UNIZAR.
- o EF2: Nanostructured material and membrane modelling and simulation will be organised by FORTH/ICE-HT.

The second part of the programme will address three applications in 3 training courses

- o EA1: Nanostructured materials and membranes for Energy simulation will be organised by SINTEF.
- o EA2: Nanostructured materials and membranes for Health simulation will be organised by UTwente.
- o EA3: Nanostructured materials and membranes for Food Processing simulation will be organised by ITM-CNR.

Actually, NanoMemCourse is at negotiation stage. We must attain the contract signature to be sure of NanoMemCourse funding.

Further information on SCF programme can be found in <http://cordis.europa.eu/mariecurie-actions/scf/home.html>

Javier Escudero and Pierre Aimar

PhD thesis defended

Valérie TANNEUR - Supervisor: G. Rios - 9 May 2006

"Study of a contactor with fluidized CO₂ bed under pressure. Application to the coating of particles by process RESS"

Watchanida CHINPA - Supervisors: C. Dupuy et A. Deratani - 30 March 2006

"Study of the relations between transfers of matter and structuring during the elaboration of membrane of poly(etherimide) by separation of phase induced by absorption of steam"

Julius MOTUZAS - Supervisor: A. Julbe - 4 July 2006

"Interest of the microwaves for the synthesis of germs and zeolitic membranes"

Promotion

HDR Stéphanie ROUALDES - 19 July 2006

"Development of original membranes by polymerization plasma. Applications to the fields of the environment and the energy production"

New Students and Post-doc

S. BOUAICH - Supervisor: S. Lacour - 10 April 2006

"Extraction of ions using ion exchange textiles in complexed diluted medium"

A. CAZACU - Supervisor: M. Barbiou - 1 June 2006

"Macrocyclic functionalized sensors like analytical reagents and transporteurs for membranes"

S. EL KEDIDI - Supervisor: A. Deratani - 27 Feb 2006 "Preparation of enzymes membranes to fight against fouling"

E. FEMMININO - Supervisor: S. Lacour - 27 Mar 2006,

"Ions extraction using ion exchange textiles in complexed diluted medium"

E. GERARDIN - Supervisors: A. Julbe and V. Rouessac -

8 April 2006 - "Analyses of gas permeation within the framework of ADEME ARMANASOL contract"

L. GROSMAlRE - Supervisor: P. Sostat - 1 May 2006

"Comprehension of the transport mechanisms of intrinsic water in the composite SIM membranes"

F. ELLOUZE - Supervisor: A. Deratani - 9 Mar 2006

"Experimental study and predictive simulation of the permeation of neutral aqueous solutions for membrane material characterization"

S. S. LALMI - Supervisor: C. Innocent - 14 May 2006,

"Coupling of textiles modified with exchange ion membranes for the selective extraction of heavy metals"

E. MAHON - Supervisor: M. Barbiou - 2 April 2006 "Membrane materials for biotechnologies: nanostructuration supramoléculaire and dynamic combinatorial"

F. SALAH - Supervisor: A. van der Lee - 7 February 2006

"Reflectrometrie of x-rays in shaving incidence"

O. MOINE - Supervisor: M. Rivallin - 15 March 2006

"Development of a 'in-situ' granulometric measurement based on the diffusion of the light"

R. MOLINER - Supervisor: A. Deratani - 5 May 2006

"Feasibility study of the waste water treatment of the ceramics industry by membrane processes"

H. SAIDANI - Supervisor: A. Deratani - 16 February 2006

"Study of the temperature effect on the nanofiltration performance"

T. MINON - Supervisor: S. Tingry - 5 June 2006

A. MOURGUES - 1 February 2006 - Modelling

NanoMemPro Departure

John PALMERI has left CNRS-IEM on July 2006. He was strongly involved in NanoMemPro as contact person for CNRS for the WP08 and coordinator of "Process Scale Modelling of NF" exercise. He is now at "Theoretical Physics Lab" in Toulouse (France).

Formations/Conferences

12-13/04/06

"Membranes and Energy: Membrane for piles and batteries, and biocatalytic devices"

Organised by Christophe INNOCENT

5/09/06

"Nanoporous Capsules/Artificial Cells: From Aesthetics to Multifunctionality"

Professeur Achim MÜLLER University of Bielefeld (Germany).

New book: Proteins at Solid-Liquid Interfaces

Déjardin, Philippe (Ed.) 2006, XVI, 330 p., 162 illus., Hardcover.
ISBN: 3-540-32657-X

Written for scientists and graduate students in physical chemistry, biophysics, biochemistry and biotechnology; research engineers, this book opens with a description of fundamental aspects of protein adsorption to surfaces, a phenomenon that plays a key role in biotechnological applications, especially at solid-liquid interfaces. Presented here are methods for studying adsorption kinetics and conformational changes such as optical waveguide lightmode spectroscopy (OWLS). Also described are sensitive bench techniques for measuring the orientation and structure of proteins at solid-liquid interfaces, including total internal reflection ellipsometry (TIRE), dual polarisation interferometry (DPI) and time of flight - secondary ion mass spectrometry (TOF-SIMS). A model study of fibronectin at polymer surfaces is included, as are studies using microporous membranes and textiles with immobilized enzymes for large-scale applications. Biocompatibility, anti-fouling properties and surface modification to modulate the adsorption and activity of biomolecules are among the other topics addressed in this invaluable book.

Keywords: Adsorption, Biocompatibility, Fibronectin, Membranes, Protein-Protein Interactions, Spectroscopy.

More information on :
http://www.springer.com/shop/ppm-media/ppmMedia.jsp?SGWID=5-138-22-153035481-print_view=

NanoMemPro Lillehammer workshop *Scattering and X-ray spectroscopy characterization techniques for membranes and porous materials*

On June 25th, 2006, at the eve of the ninth International Congress on Inorganic Membranes in Lillehammer, Norway, a workshop entitled "Scattering and X-ray spectroscopy characterization techniques for membranes and porous materials" took place. It was organized as a spin-off activity of WorkPackage 1.2 of the European Network of Excellence NanoMemPro. From the 25 participants (including the lecturers) to the workshop, approximately 40% did not belong to the NanoMemPro network.

The emphasis of this first membrane-related workshop on characterization techniques was given to more-the-less classical techniques related to X-ray diffraction, X-ray and neutron small angle scattering, X-ray reflectivity, X-ray photo-electron spectroscopy, X-ray fluorescence, and ellipsometry. The speakers were asked to divide their talk in two parts, the first part covering the basics and the second part dealing with the applications in the field of membranes and mesoporous materials.

Four of the six speakers were members of the NanoMemPro network (Dr. Kontoyannis, Dr. Irusta, Dr. Van der Lee, and Dr. Rouessac). The coordinator of the Inside-Pores network, Dr. Kanellopoulos was asked to give his view on the small-angle scattering technique and to present the Inside-Pores network. The sixth speaker, Dr.

Amenitsch, is at present not involved in either NanoMemPro or Inside Pores networks.

Dr. Arie van der Lee from the Institut Européen des Membranes (Montpellier, France) gave a presentation on the X-ray reflectometry analysis of porous materials. Dr. Heinz Amenitsch (IBR-Elettra group, Trieste, Italy) showed how synchrotron radiation can be used to analyse mesoporous materials. Dr. Christos Kontoyannis from the Department of Pharmacy (University of Patras, Greece) presented the basics of X-ray fluorescence and its applications.

Dr. Vincent Rouessac from the Institut Européen des Membranes (Montpellier, France) gave an overview of ellipsometric porosimetry and how it can be used to investigate the porosity of supported thin films and membranes. Dr. Silvia Irusta from the Catalysis and Reactor Engineering Group (University of Zaragoza, Spain) showed the possibilities of the recently installed XPS machine in Zaragoza. Dr. Nick Kanellopoulos from the Materials & Membranes for Environmental Applications Laboratory (Athens, Greece) gave a presentation on the combination of SAXS/SANS with other in-situ and ex-situ techniques for the characterization of porous materials and presented some highlights of the Inside Pores network.

A. van der Lee (CNRS-IEM - Montpellier) and M. Fontaine (SINTEF -Oslo)

Ph.D.

Guillo Schrader - March 31, 2006
Direct nanofiltration of waste water treatment plant effluent

Maik Geerken - Nov. 9, 2006
Membrane emulsification

Zandrie Borneman - Nov. 15, 2006
Membrane adsorbers

Tymen Visser - November 24, 2006
Membranes for gas separation

Jörg Balster - December 13, 2006
Bipolar membranes

Dr. Sairam Malladi joined Imperial College group in August 2006. Dr Malladi received PhD from Jawaharlal Nehru Technological University, Hyderabad, India on “Synthesis and characterization of polyaniline and its nanocomposites: catalytic and electrostatic discharge applications”. Later as research associate at Karnataka University, Dharwad, India, he worked on nanocomposites of polyaniline and development of nanocomposite membranes for the separation of aqueous-organic mixtures. His research also included development of polymeric micro and nanoparticles for controlled drug release applications. Currently Dr. Malladi is working on the development of nanofiltration membranes in the department of chemical engineering and chemical technology, Imperial College, London.

Nano-engineered artificial membranes for a better life

Sunday 16 July | 17.15 – 18.30
Forum am Deutschen Museum | Room Helios

There is no life without membranes since each living cell is encased by a biological membrane, which regulates the exchange of matter with the external environment. Artificial membranes also play a key role both in modern industry and medical therapy. Millions of people would suffer from contaminated water without membrane filtration. Reverse osmosis is today's leading technology to generate drinking water from sea water. Developments in nanotechnology may produce breakthroughs in membrane design such as the integration of carbon nanotubes, greatly increasing their efficiency. It is possible to predict breakthroughs in fuel cell membranes, leading to advances in energy production. These prospects have led to an integrative activity within Europe.

KLAUS-VIKTOR PEINEMANN (Organiser & Participant)
Institut für Polymerforschung
Forschungszentrum Geesthacht (GKSS)
Germany
■ Nanostructured membranes for a sustained development

GILBERT RIOS (Co-Organiser)
Institut Européen des Membranes
Ecole Nationale Supérieure de Chimie de Montpellier
Montpellier, France

THOMAS GROTH (Participant)
Biomedical Materials Group
Institute of Pharmaceutics and Biopharmaceutics
Martin-Luther-Universität Halle-Wittenberg
Germany
■ Membranes for bioartificial organs

YVES-MARIE LEGRAND (Participant)
Institut Européen des Membranes
Montpellier, France
■ Mimicking biological functions of the cell membrane: near future or utopia?

M. WESSLING (Participant)
Faculty of Science and Technology
University of Twente
Enschede, The Netherlands
■ Is there life without membranes?



University of Twente
The Netherlands

Papers

I. Frenzel, H. Holdik, V. Barmashenko, D.F. Stamatialis, M. Wessling, *Electrochemical reduction of dilute chromate solutions on carbon felt electrodes*, Journal of Applied Electrochemistry 36 (2006) 323-332.

M. Gironès, R.G.H. Lammertink, M. Wessling, *Protein aggregate deposition and fouling reduction strategies with high-flux silicon nitride micro-sieves*, Journal of Membrane Science 273 (2006) 68-76.

I. Frenzel, D.F. Stamatialis, M. Wessling, *Water recycling from mixed chromic acid waste effluents by membrane technology*, Separation and Purification Technology 49 (2006) 76-83.

L. Vogelaar, R.G.H. Lammertink, M. Wessling, *Superhydrophobic Surfaces Having Two-Fold Adjustable Roughness Prepared in a Single Step*, Langmuir 22 (2006) 3125-3130.

FORTH/ICE-HT

Synthesis and modification of nanostructured mixed-matrix membranes for hydrogen recovery improvement

A project titled “Synthesis and modification of nanostructured mixed-matrix membranes for hydrogen recovery improvement “ has been approved for funding by the General Secretariat for Research & Technology of the Greek ministry of development. The project is a collaboration between FORTH/ICE-HT and the School of Chemical & Biomolecular Engineering, Georgia Institute of Technology. Dr G. Voyiatzis, Dr V. Nikolakis and Dr V. Drakopoulos are members of the research team at FORTH/ICE-HT. Prof. S. Nair and W. J. Korros are the collaborating faculty members at Georgia Institute of Technology.

S&B Industrial Minerals SA are also participating in the project as suppliers of materials to be tested.

The aim of the project is to synthesize and modify composite polymeric membranes with dispersed permeable nanomaterials (nanocrystals or nanoflakes). Both type mixed-matrix membranes will be tested as gas separation membranes for hydrogen recovery from model mixtures encountered in ammonia plant purge gas streams (N_2 or CH_4), in different processes met in refineries (light hydrocarbon streams) and in the product of hydrocarbon stream reforming (CO_2 and CH_4).

O. de la Iglesia, M. Pedernera, R. Mallada, Z. Lin, J. Rocha, J. Coronas, J. Santamaría, *Synthesis and characterization of MCM-48 tubular membranes*, Journal of Membrane Science 280, 1-2, 867-875 (Sep 2006)

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M. Pera-Titus, R. Mallada, J. Llorens, F. Cunill, J. Santamaría, *Preparation of inner-side tubular zeolite NaA membranes in a semi-continuous synthesis system*, Journal of Membrane Science, 278, 1-2, 401-409 (Jul 2006)

V. Sebastián, Z. Lin, J. Rocha, C. Téllez, J. Santamaría, J. Coronas, *Synthesis, characterization, and separation properties of Sn- and Ti-silicate umbite membranes*, Chemistry of Materials, 18, 10, 2472-2479 (May 2006)

Vilaseca, M., Yagüe, C., Coronas, J., Santamaría, *Development of QCM sensors modified by AlPO₄-18 films*, Sensor and Actuators B-Chemical, (Sep 2006) 117 143-150

R. Fernández-Pacheco, M. Arruebo, C. Marquina, R. Ibarra, J. Arbiol, J. Santamaría, *Highly magnetic silica-coated iron nanoparticles prepared by the arc-discharge method*, Nanotechnology, 17, 5, 1188-1192 (March 2006)

M. Arruebo, M. Galan, N. Navascués, C. Téllez, C. Marquina, MR. Ibarra, J. Santamaría, *Development of magnetic nanostructured silica-based materials as potential vectors for drug-delivery applications*, Chemistry of Materials 18, 7 1911-1919 (Apr.2006)

A. Navajas, R. Mallada, C. Téllez, J. Coronas, M. Menéndez, J. Santamaría, *The use of post-synthetic treatments to improve the pervaporation performance of mordenite membranes* Journal of Membrane Science 1, 270, 1-2, 32-41 (feb 2006)

V. Sebastián, Kumakiri I., Bredesen R., Menéndez M., *Zeolite Membranes for CO₂ removal: operating at high temperature*, Desalination, 199 (2006).

Nanoscience Institute at UNIZAR leads large research consortium on Nanotechnologies in Biomedicine

The Aragon Nanoscience Institute (INA) at Zaragoza University leads a consortium with several research centers including University of Santiago de Compostela, University of Vigo, Catalonia Nanotechnology Institute, Institute of Materials Science of Barcelona, Microelectronics National Center and Barcelona Microelectronics Institute, Autonomic University of Barcelona, the Institute of Nanoscience and Nanotechnology at Barcelona University, as well as, the Barcelona Science Park to develop the project entitled: Nanotechnologies in Biomedicine.

The project has a budget of 4.5 M€ from 2006 to 2010 founded by the Spanish Ministry of Education within the CONSOLIDER-INGENIO 2010 program.

The Consolider Team NANOBIOEMED combines joint expertise of relevant scientists from different research areas (Physics, Chemistry, Biochemistry, Pharmacy, and Medicine) in an

attempt to solve borderline problems by using nanotechnology in the field of biomedicine. The objectives of the Team are focused on the applications of nanoparticles in two important areas: Nanotherapy and Nanodiagnosis. The aim is to develop new approaches in the field of drug delivery. The use of nanoparticles will allow targeting the drug toward the malignant region of the body avoiding collateral non-desirable side effects. This is significantly important in the case of cancer treatment with cytostatic agents. Nanoparticles with different functionalities for physical targeting and methods of functionalization their surfaces in order to attach bioligands which can biochemically recognize the targeted organ will be studied. In the field of Nanodiagnosis, nanoparticles will be used in order to detect a determined antigen in an analyte by using "batch" based biosensor platforms. Miniaturized electrodes based on electrochemical platforms will be

developed by using the most advanced nanolithography techniques. An application based in "lateral flow" biosensors will be developed for quantification the presence of antibiotics in food.

Early detection of malignant tumors is a challenge that we plan to pursue within this project. Our approach is based on new methods to develop smart contrast agents to enhance the MRI contrast signal. Standard or improved SPION (superparamagnetic iron oxide nanoparticles) will be functionalized and tagged with adequate bioligands in order to concentrate the nanoparticles in the neighborhood of the incipient tumor region. Another approach will be the targeting of the contrast agent by dendritic cells which have great affinity for the tumor cells.

For additional information, please contact Dr. Manuel Arruebo (arruebom@unizar.es).