NanoMemPro newsletter

"Expanding membrane macroscale applications by exploring nanoscale material properties"

"European Membrane House": statutes are under work

Defining the future legal status of the network is vital for its existence and further development of its activities beyond EC funding. This is one of the top priorities for NanoMemPro. During the past months, an important work has been done on the draft version of the statutes of the European Membrane House. Prof. Gilbert M. Rios, NanoMemPro coordinator and WP05 leader, has endeavoured to integrate all the comments and remarks received from the partners, as well as suggestions coming from the European Membrane Society. The final version of the statutes has been reviewed and adopted by the partners in the last NanoMemPro semi-annual meeting in Prague (April 17th-19th 2007).

The objective is to make the EMH operate as soon as possible. Its four main tasks will be to: act as a melting pot for ideas, tools and means, represent its members' interests and advise regional, national and European institutions on new orientations and challenges, facilitate the constitution of consortia and submission of collaborative technological projects, help people mobility and job creation. Incomes will be provided by member fees and overheads on new contracts set up through the EMH.

The EMH will aggregate three kinds of members: NanoMemPro partners and the European Membrane Society as *Founding members*, additional laboratories selected for their scientific and technical expertise as *Associate members* and finally, as *Club of Interest members*, companies and other associations interested in membranes so as to develop the best synergies.

"*Associate members will be proposed by a Scientific Council and will join for a limited period of time.*" explains Prof. Gilbert M. Rios. *"Associate members will be labs which have a prominent position in Europe in their respective area of application as well as a lot of industrial contacts: as examples, the University of Wageningen in The Netherlands or INRA in France for the food area, the University of Compiègne in France in the field of artificial organs, the University of Oviedo in Spain for environmental applications. They were participating in our recent SBRA workshops of February 7th-8th in Brussels. Their contribution was particularly appreciated. They are interested in the EMH and do agree to continue this experience with us.*

A few important labs from the most recent EC countries could also be offered to join the European Membrane House in the future. They will be presented this opportunity in a special event organised next April in Prague on the occasion of NanoMemPro's semi-annual meeting.

NanoMemPro's Club of Expertise was something important in our initial project. This idea will thus be totally integrated within the framework of the European Membrane House."

The last version of the EMH statutes is available on Project Place: Document Archive/WP05/Records

Partners' letters are available on Project Place: Document Archive/WP05/Deliverables/D05.2_WP05_CNRS_ed1.pdf

Info
Newsletter of the
Network of Excellence
"NanoMemPro"
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European Membrane Strategic Business and Research Agenda:
second round of workshops with industrialists

The second phase or Mapping phase towards the SBRA set-up is on progress. The goal of this phase is to draw possible routes merging industrial needs and academic dreams to reach the targets for innovation as identified in the first phase. NanoMemPro members and industrialists gathered for two days of workshops to start discussing potential routes.

The first phase in the preparation of NanoMemPro's Strategic Business and Research Agenda for Membrane Technologies in Europe allowed identifying and specifying industrialists' needs. This phase concluded in September 2006 with a first series of workshops with industrialists to validate targets for innovation.

Each NanoMemPro partner institution was then asked to contribute a document summarizing its research perspectives or dreams.

On 7th and 8th of February, NanoMemPro organised a second round of workshops. About 55 people attended each day. More than 30 companies (producers, engineering companies and end users) participated to discuss with NanoMemPro's experts about the future membrane developments that will impact their industry in the future and to react to the most promising research options to be chosen. This exchange provides the necessary input to draw the expected roadmaps towards shared research and development ambitions.

Six one-day workshops were held, each dedicated to a specific industrial sector. They were moderated by members of NanoMemPro and addressed several topics:

• **Chemicals** - Prof. Joao Crespo (IBET-UNL) and Dr. Kang Li (Imperial College) - Integration of membrane technologies and process intensification, solvent media treatment with membrane processes, new membrane applications, monitoring, simulation and process design.

• **Food** - Dr. Loredana de Bartolo (ITM-CNR) and Prof. Gilbert Rios (CNRS-IEM) - Innovative membrane based processes in food production and processing, integrated membrane processes, new packaging, membrane processes to control and improve food texturation.

• **Energy** - Dr. Rune Bredesen (SINTEF) and Dr. Henk van Veen (ECN) - H2 and CO2, fuel cells, gas treatment, new membranes.

• **Health** - Dr. Loredana de Bartolo (ITM-CNR) and Prof. Maria Noberta da Pinho (IBET-IST) - Bioseparation, biocompatibility.

• **Environment** - Dr. Inge Genne (Vito) and Dr. Pierre Aimar (CNRS-LGC) - Membranes as "Best Available Technologies" for environmental issues, drinking water membrane production processes vs. traditional physico-chemical processes, membrane desalination processes for drinking water vs. thermal processes.

• **Membrane materials** - Dr. Klaus-Viktor Peinemann (GKSS), Prof. Miguel Menendez (UNIZAR) and Dr. Vasilis Burganos (FORTH/ICE-HT) - Inorganic membranes, polymeric membranes, hybrid membranes, modelling and simulation for improved material design.

Companies and technological centres from all sectors were represented (Air Liquide, Aquasource, Areva, Arla Foods, CEA, CoMeTas, Degremont, Degussa, DGMT, DHI Group, DSM, ECN, Fluxxion, Fresenius MC, Gaz de France, Global Membrains, Groupe Bel, GVS, IFP, Kiwa, Lonza, MAST Carbon, Mega, Membrana, Norit X-Flow, Ondeo, Pall, Pernod Ricard, Rhodia, Sanofi Pasteur, Solvay, Sulzer, TNO, Total, Unilever, and VTT). Their members met experts from NanoMemPro, but also from other institutes (Technological University of Compiègne, University of Oviedo, University of Wageningen, and Energy Research Center of the Netherlands) associated for their scientific excellence.

Fruitful discussions have well been started up. However deep they could go most of the companies showed in any case keen interest in this initiative and wish this dialogue can be continued. They were also quite interested in the project of the European Membrane House (*see article on the front page*) which they were presented on this occasion.

The presentations made during the workshops as well as those reporting their outcomes will be available on NanoMemPro web site.

Membrane Processes as *Best Available Techniques* and as Candidates to BAT in the Integrated Pollution Prevention and Control Directives

Lisbon, Portugal, January 19th 2007

A public seminar entitled "**Membrane processes as Best Available Techniques (BAT) and as candidates to BAT in the Integrated Pollution Prevention and Control (IPPC) directives**" was organized by IBET in collaboration with the Portuguese Institute of Environment (IA). The seminar was a result of the work developed after the initial contacts established between IBET and the Portuguese Institute of Environment.

The seminar included an introductive presentation about membrane processes, a presentation of NanoMemPro, and several presentations exemplifying the use of membrane processes as BAT in key industries. In the latter, invited speakers from international companies described the use of membrane processes in the pulp and paper, dairy, automotive and textile industries.

Programme summary:

- "The use of membrane processes in Industry", by Maria Norberta de Pinho (IBET)
- "Presentation of the European Network of Excellence NanoMemPro", by João Paulo Crespo (IBET)
- "Closing the loops in the pulp and paper industry with membrane technology", by Frank Lipnizki (Membrane Technology, Alfa Laval Copenhagen A/S, Denmark)
- "Processes for treatment of cheese whey", by Hans Henrik Holst (Arla Foods, Denmark)
- "Operation of UF-membrane systems as part of wastewater treatment in the Automotive Industry", by Manfred Rick (Ford Land, Germany)
- "Membrane applications in the textile industry", by Frank Lipnizki (Membrane Technology, Alfa Laval Copenhagen A/S, Denmark)

The seminar was attended by approximately 400 participants from industry and environment related institutions, thus becoming a highly participated and successful event.

Exchange of people

University of Twente (The Netherlands) ⇨ IEM (France)

Starting from March 5th, Julius Motuzas, postdoctoral researcher at the University of Twente (Nl), visited the Institut Européen des Membranes (IEM) in Montpellier (Fr) for a period of one week. This visit was a good way to enhance a long-lasting collaboration between IEM and UTwente in the field of membranes. The goal of this trip was to synthesize three series of homogeneous nanosized zeolite crystals using a MW-assisted synthesis method developed at IEM. These seeds will be used at UTwente for preparing zeolite-polymer composite membranes.

Julius currently holds a postdoc position in the Membrane Technology Group and he is working on ceramic membrane synthesis with sol-gel methods. He obtained his PhD degree at IEM last year. His PhD research was dedicated to zeolite nanocrystal and thin membrane synthesis under MW irradiation.

This short stay makes it possible for both institutions to explore how to combine their knowledge (IEM - synthesis of homogeneous, nanosized zeolite crystals; UTwente - preparation of polymeric membranes) and prepares for potential future collaboration and projects.

WP10.4 - Back-design and Mass Production of Membrane Material

A report on the progress made in membrane activities in China, Korea and Russia will soon be delivered. The current state of research and the applications of membrane science and operations in each of these countries are the main subjects investigated. All reports include a list of companies manufacturing and supplying membranes and membrane devices. A significant part of the information collected on membrane research and applications has been extracted from reports already elaborated in these countries. For the most part, information about membrane market development has been reached through websites.

WP12 - Joint Training and Education Program

Prof. Enrico Drioli has been appointed as coordinator and responsible for a European Doctorate on Membrane Engineering. The aim of the PhD courses is to consolidate an innovative figure, the "membrane engineer", which represents a necessary conjunction ring between academic research and the industrial world interested in membrane systems. The European Membrane Society will operate together with NanoMemPro and with universities delivering the diploma in the actions for realising this strategy.

The PhD courses will cover three years. The first year will be conducted in the Institute/University of origin. In the following period, each PhD student will carry out a part of his/her activities in a different Institute/University for at least one year, having also the possibility of presenting an industrial research project. Two supervisors, with at least one being from a country different from the one of origin, will follow his/her studies.

Many are the major areas of interest of research in progress. They include:

- Energy and environment
- Innovation in products and processes
- Nanostructured materials
- Life science and biotechnology
- Food treatment
- Drug delivery systems
- Regenerative medicine
- Life in space
- Security
- Microelectronics.

WP6.1 – Increase Financial Autonomy and Durability

Focus on Food and Health workshops

In the preparation of NanoMemPro SBRA, ITM-CNR was involved in the organisation of the workshops dedicated to Food and Health.

The Food workshop, chaired by Dr. Loredana De Bartolo and Prof. Gilbert Rios, was attended by representatives of the industrial world (Arla Foods, Bel, Mega, Pernod-Ricard, Solvay, Unilever) together with NanoMemPro members (ITM-CNR, CNRS-IEM, CNRS-LGC, IBET-IST, VITO) involved in the related workpackage, as well as a representative of the University of Wageningen (The Netherlands). The activities of WP11.2, coordinated by Dr. Lidietta Giorno, were presented and discussed focusing on the analysis of the use, needs, future perspectives of membranes and membrane operations in food in order draw the expected strategic agenda. For each sub-issue, drivers and brakes of several research topics were discussed. Development of new smooth and well-focused technologies working at the molecular level, starting from the new concept of biocatalytic membrane reactors, biosensors, affinity membranes and membrane contactors were shown. Integrated processes for new sustainable manufacturing processes to improve product quality, to minimize wastes, to design new technological routes were discussed with industrialists, who found the research topics satisfying and expressed their opinions regarding innovative research targets.

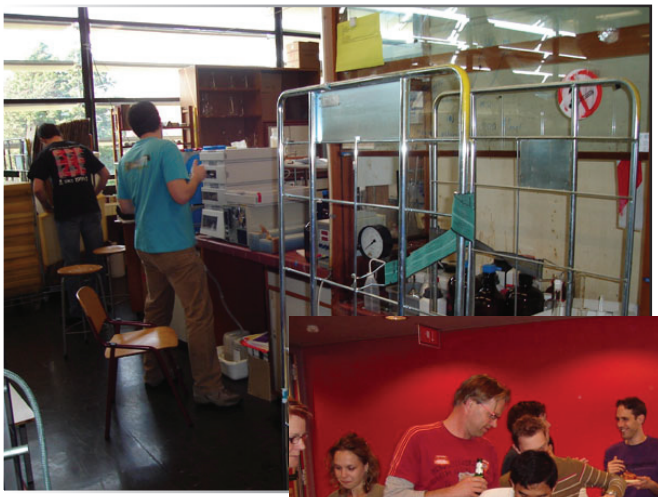
The Health workshop was moderated by Dr. Maria Norberta De Pinho and Dr. Loredana De Bartolo. The participation of industrialists from Arla Foods, ECN, Fluxxion, Fresenius MC, GVS, Lonza, Sanofi Pasteur was very active. The network activities in WP11.4, coordinated by Dr. Dimitris Stamatialis, were shown and focused on bio-separation for the pharmaceutical industry, biocompatibility, intelligent membranes and medical devices. Key research and development topics such as membrane manufacturing, characterisation of membrane and membrane-cell/blood interactions and membrane device/biohybrid systems were overviewed. Industrial requirements were oriented towards more efficient, robust and less expensive technologies. Besides membrane application in the hemodialysis and plasmapheresis field, which is well established, and for which industrial production reached optimal dialysis membranes, particular interest was expressed in new approaches to modify membranes to improve cell compatibility and non-fouling membranes. New applications of membranes in tissue engineering and regenerative medicine were shown. Industrialists, NanoMemPro scientists (from IBET-IST, ITM-CNR, CNRS-IEM, CNRS-LGC, GKSS), and a researcher of the Technological University of Compiègne (France) discussed new strategies regarding research and development in membrane and membrane devices for pharmaceutical and medical applications. Future perspectives will target the development of membranes with enhanced biocompatibility and functionality.

NanoMemCourse: Nanostructured Materials and Membrane Training Course

Within the framework of NanoMemCourse: Nanostructured Materials and Membranes Training Course, funded under the Marie Curie (SCF) programme, ITM-CNR will lead and organize the course on Food Processing in 2010.
Scientific contents of the course will include: membranes and membrane processes in food applications, future needs for sustainable food production and processing, new perspectives from new membrane processes for food formulation (contactors, emulsification, encapsulation, biocatalytic reactors) and packaging.

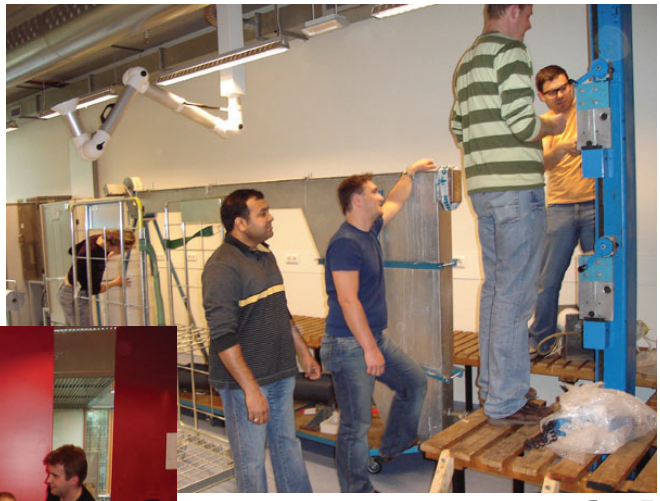
New building for Membrane Technology Group

This April, the Membrane Technology Group (Membranes & Interface Science, Inorganic Membranes and EMI Twente) moved to a new building: Meander. The name of this new building is chosen because the new building meanders around the trees in that area. The location is very close to the location of the old building of Chemical Technology and it is connected to the Horst tower, which is the location where all the teaching activities of the faculty of Science & Technology are concentrated. Meander hosts several other research groups. Most of these groups belong to the research institute Impact, which focuses on process technology and more specifically on Sustainable Energy & Green House Gas Emission and Smart Devices & Materials. The pictures on this page show a glimpse of the new building and of the moving activities.



Day 1...

First borrel in the new building



...Day 7

Aachener Membran Kolloquium

The 11th Aachener Membran Kolloquium (AMK), Germany's membrane conference on industrial applications of membrane technology, supported by the Institut für Verfahrenstechnik of RWTH Aachen University and the Network of Excellence NanoMemPro, took place on March 28th - 29th 2007. This brokerage event offered a common platform for developers, producers and customers from all over Europe in the area of membrane technology.

On this occasion, ITM-CNR was present and offered its expertise in various areas of membrane science and technology. In particular, the latest results on the research activities carried out in the fields of bio-hybrid membrane systems, desalination and industrial water treatments, membrane contactors, new membrane development, membrane characterisation and membrane process were shown.

University of Twente
The Netherlands

Nanostructured Materials & Membranes Training Course

Following its successful ranking at the last FP6 call, NanoMemPro members' proposal has been accepted by the EC. NanoMemCourse has officialy been launched in February and more events are to come.

What is NanoMemCourse?

The NanoMemCourse project is a series of training courses designed to deliver to the young researchers the most relevant state-of-the-art knowledge on nanostructured materials for a career development in line with the scientific, industrial and social needs and challenges. The project will cover both the fundamental knowledge and three fields of application, with a high and long-term potential, in order to draw maximum interest from the young and senior international scientific and industrial communities.

The objectives of the training courses were identified by the Network of Excellence as those European research should focus on, to gain competitiveness in the next decade:

- **Develop excellence** in the modelling/simulation and the synthesis/characterisation of nanostructured materials and processes
- **Strengthen the links** between academic research and industry in the different scientific disciplines involved in nanonostructured materials and membranes
- **Create a multidisciplinary European community of young researchers** involved in nanostructured materials at the most advanced level, basis of the future decision makers in this field in Europe

The project will train and orientate a critical mass of 300 young researchers in these directions, which will reinforce and structure the EU research on nanostructured materials on the one hand, and should lead to a significant step forward in the development of nanoscale membranes and their taking-up by industry in a wider range of applications and markets on the other hand.

The first part of the programme will target fundamental knowledge, with two training courses:
- **EF1**: Nanostructured material and membrane synthesis and characterisation
- **EF2**: Nanostructured material and membrane modelling and simulation

The second part of the programme will address three applications in three training courses:
- **EA1**: Nanostructured materials and membranes for energy
- **EA2**: Nanostructured materials and membranes for health
- **EA3**: Nanostructured materials and membranes for food processing

NanoMemCourse is more than a summer school. It is designed to offer a coherent series of scientific topics from fundamental knowledge to technology and industrial applications. Transversal topics such as knowledge management, technology transfer, EU RTD project management, and specific topics related to each application, like industrial/societal issues, EU standards/regulations and ethics will also be integrated as part of the complementary skills to be acquired by young researchers. All the training courses will be based on the same format including lectures, conferences and practical courses (hands-on experience of materials, processes and analytical tools, and in situ observations or field studies).

Interdisciplinary academic and industrial approaches will be presented and discussed by keynote speakers and experts from both the scientific and industrial communities.

The first course will take place at the University of Zaragoza, Spain, from November 7th to 16th

The first course – EF1 - Nanostructured material and membrane synthesis and characterisation – will provide a broad knowledge on the general aspects of synthesis and characterisation. It will encompass the state-of-the-art developments in nanostructured materials, including catalysts and adsorbents, with a particular emphasis on membrane synthesis and characterisation-related aspects. In addition to lectures on scientific issues, an overview of research outside the EU as well as the industrial point of view will be presented. Attenders will visit an industrial site and research laboratories, where they will have some hands-on tranining. A poster session, in which the participants will present their own research activities, will serve as a starting point for a simulation exercise "Synchronising European Research".

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Young researchers from the NoE but also from partner institutes and companies are strongly encouraged to attend.

Provided they are eligible, applicants can be granted a travel and living allowance. Non-eligible participants or eligible applicants who will not have been selected for a grant can however participate. All participants will have to pay registration fees.

The detailed course content as well as the deadlines for applying are available on NanoMemCourse website: http://www.nanomemcourse.eu.

For additional information, ask: nanomemc@unizar.es.

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE

CNRS-IEM: New Staff

On December 1st 2006, Marie-Laure Fontaine joined CNRS-IEM as Research Scientist in the Sol-Gel Plasma - SGP group (preparation of ceramic and hybrid membranes via sol-gel and plasma routes). She will work on the development of dense porous membranes for energy and environment applications. Marie-Laure has a PhD degree in material science that she prepared in the CIRIMAT laboratory (Toulouse, Fr) studying the elaboration and characterisation of cathodic thin films for SOFC applications. She then worked on the preparation via colloidal ceramic suspensions of duplex microstructure cathodes for SOFCs, before joining SINTEF (No) as postdoctoral fellow and finally research scientist, with the preparation of multilayered ceramic devices for energy related applications as research topic.

NanoMemPro Equipment Database is available online

Within the framework of the implementation of a European Membrane Laboratorium (WP06.2), IBET-UNL has developed an online equipment database to improve and facilitate the access of NoE partners, CoI members and external users to a large number of research infrastructures existing at the different partners. Through the operation of this database, NanoMemPro aims at optimising equipment sharing and management procedures: easy information update, search for available equipment, technical characteristics and conditions of access, on-line equipment booking.

The equipment database is available since March 2005, and can be directly accessed through the NanoMemPro website (http://www.nanomempro.com, choosing Project and NanoMemPro databases sections) upon individual registration, by filling in a registration form available at the same location.

Entering the equipment database, the users have access to equipment forms containing information about the equipment type, purpose, capacity, location, access conditions and contact person. In addition, the equipment forms also include information regarding specific analytical conditions: size, dimension, amount of the sample to be analysed, level of detection and accuracy.

Through the use of this database, an updated record of use can be maintained for each piece of equipment, including the name and the institution of the user, the purpose of a specific period of utilization, the starting and ending dates of utilisation. Based on this information, equipment reports can also be elaborated which may be used for supporting decisions regarding equipment acquisition or the need for specific training courses.
For the time being, the NanoMemPro equipment database accounts with approximately 160 registered individuals, among which NoE, CoI and Industry users.

New functionalities are being designed to allow the transfer of membrane samples between the users.
In addition, it will be extended as a relational database including information about membrane materials, their characterisation and performance under defined conditions, in order to support the development of new software tools for modelling and simulation.

Information on the use and functionalities of the equipment database are permanently updated at https://www.projectplace.com; information can also be obtained through the system administrator, Carla Portugal, at cmp@dq.fct.unl.pt.

INSTITUTO DE BIOLOGIA EXPERIMENTAL E TECNOLÓGICA IBET

CNRS-IEM

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE

Courses/Conferences

September 14th-15th 2006
Workshop France – Taïwan: "Membranes and their applications".

October 20th 2006
Conference: "From polyfluorenes, conducting polymers with multiple properties to dispirofluorene-indenofluorenes: New emitting materials for blue electroluminescent diodes", Dr. Joëlle Rault-Berthelot, Université de Rennes, France.

November 6th 2006
Conference: "Probing of polyelectrolytes' and particles' adsorption by streaming potentia", Dr. Piotr Warszynski, Institute of Catalysis and Surface Chemistry, Polish Academy of Sciences, Krakow, Poland.

November 11th 2006
Conference: "Zeolite functional architectural elements in chemical microsystems", Dr. King Lun Yeung, Associate Professor, Department de Chemical Engineering, Hong Kong University of Science and Technology.

January 18th-20th 2007
On the 18-20th of the January just past, researchers from ten institutes and five industrial partners gathered at IEM to present research and discuss ideas. They congregated as members of the DYNAMIC Marie Curie Research Training Network. This network, fully titled Dynamic Interactive Chemical Biology and Biomedicine, brings together leading researchers - including Nobel Laureate Prof. J.M. Lehn - from areas of supramolecular, synthetic and biomolecular chemistry with others from areas of biology, especially cell biology, genetics, physiology and biomedical science. The industrial input is supplied by partners working in genetic, surface-based sensor and drug discovery technologies. The network is coordinated from Stockholm by Olof Ramström at the Royal Institute of Technology (KTH). IEM is represented by Dr. Mihai Barboiu (Adaptive Supramolecular Nanosystems group - NSA).

Eugene Mahon IEM-NSA
More information at: http://dynamic.u-strasbg.fr/

"Research perspectives" seminars at IEM

IEM is organising scientific seminars on research perspectives in the different priority topics developed in the institute. The goal is to assess recent developments in these areas and the positioning of research carried out at IEM so as to define research directions and objectives, as well as the related resources, for the next years. Themes already dealt with are:

- Ion conducting membranes (November 22th 2006)
- Gas separation and processing (December 13rd 2006)
- Miniaturisation of membrane systems, microreactors, microseparators (January 10th 2007)
- High throughput and/or selectivity systems in liquid medium (January 24th-25th 2007).

In each seminar, external experts are invited to participate and to bring their expertise to this evaluation exercise. Prof. Joao Crespo from IBET (Pt) thus actively took part in the seminar dedicated to high throughput and/or selectivity systems in liquid medium.

Euromembrane
IEM will organise the next Euromembrane Congress in Montpellier, September 6-10th 2009.

CNRS-IEM-People

PhD thesis defended

6/10/06 - Carole ARNAL-HERAULT "Adaptive biomimetic materials programmed by self-assembling of nucleobases or by cation - π interactions" (Supervisor: Mihai BARBOIU).

20/11/06 - Bénédicte CHOMMELOUX "Zeolite membrane functionalisation: application to reaction -separation coupling (selective hydrogenation of polyunsatured hydrocarbons)" (Supervisor: José Sanchez).

20/11/06 - Audrey HERTZ "Synthesis and encapsulation of yttria stabilized zirconia particles in supercritical carbon dioxide" (Supervisor: Christian GUIZARD)

20/12/06 - Tristan DOUSSINEAU "Zeolite nanoparticles: preparation, chromophore confinement and surface functionalisation" (Supervisor: Monique Smaihi).

Promotions

19/10/2006 - HDR - Marc CRETIN "Electrochemistry and membranes for separation, detection and reaction"

16/01/2007 - HDR - Vincent ROUESSAC "Contribution to the microstructural study of a-SiOC:H thin supported layers and other porous membranes"

HDR: French accreditation to supervise research

University of Twente
The Netherlands

Papers

Saiful, Z. Borneman, M. Wessling, Enzyme capturing and concentration with mixed matrix membrane adsorbers, Journal of Membrane Science 280 (2006) 406-417.

Y. Zhang, Z. Borneman, G-H. Koops, M. Wessling, Adsorption behavior of cation-exchange resin-mixed polyethersulfone-based fibrous adsorbents with bovine serum albumin, Desalination 192 (2006) 224-233.

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M. Gironès, L.A.M. Bolhuis-Versteeg, R.G.H. Lammertink, M. Wessling, Flux stabilization of silicon nitride microsieves by backpulsing and surface modification with PEG moieties, Journal of Colloid and Interface Science 299 (2006) 831-840.

A.V. Volkov, D.F. Stamatialis, V.S. Kothimsky, V.V. Volkov, M. Wessling, N.A. Platé, Poly[1-(trimethylsilyl)-1-propyne] as a solvent resistance nanofiltration membrane material, Journal of Membrane Science 281 (2006) 351-357.

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K. Bélafi-Bakó, D. Búcsú, Z. Pientka, B. Bálint, Z. Herbel, K.L. Kovács, M. Wessling, Integration of biohydrogen fermentation and gas separation processes to recover and enrich hydrogen, International Journal of Hydrogen Energy 31 (2006) 1490-1495.

Y. Zhang, Z. Borneman, G-H. Koops, M. Wessling, Studies of adsorption of bovine serum albumin on resin mixed pes fibrous adsorbents, Acta Polymerica Sinica 2 (2006) 350-355.

M. Gironès i Nogué, I.J. Akbarsyah, L.A.M. Bolhuis-Versteeg, R.G.H. Lammertink, M. Wessling, Vibrating polymeric microsieves: Antifouling strategies for microfiltration, Journal of Membrane Science 285 (2006) 323-333.

D.F. Stamatialis, H.H.M. Rolevink, G.H. Koops, Transdermal timolol delivery from a Pluronic gel, Journal of Controlled Release 116 (2) (2006) e53-e55.

Ph.D. Defenses

Saiful (May 24, 2007)
Mixed matrix membrane adsorbers for protein and blood purification

Dana Sterescu (September 20, 2007)
Synthesis and preparation of a new generation gas separation membranes