LOF - Laboratoire du Futur

Rapport Hcéres

agence d'évaluation de la recherche
et de l'enseignement supérieur

Section des Unités de recherche

AERES report on the research unit

Laboratoire du Futur (LOF) – UMR 5258

From the

University of Bordeaux 1

CNRS

Rhodia

May 2010

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Le Président
de l'AERES

Jean-François Dhainaut

Section des unités
de recherche

Le Directeur

Pierre Glorieux

May 2010

Research Unit

Name of the research unit: Laboratoire du Futur (LOF)

Requested label: UMR

N° in the case of renewal: 5258

Name of the director: Mr Patrick MAESTRO

Members of the review committee

Committee chairman:

Mr Paul CHAIKIN, New-York University

Other committee members:

Mr Andrew GRIFFITHS, University of Strasbourg

Mr Carlos MARQUEZ, University of Strasbourg

Committee members suggested by CNU, CoNRS, CSS INSERM, CSS INRA, INRIA, IRD:

Mrs Nicole MOREL-DESROSIERS, member of the CNU

Mr Michel RAWISO, member of the CoNRS

Observers

AERES scientific advisor

Mr Régis REAU

University, School and Research Organization representatives

Mr C. DESNOST, Head of Advanced Innovation Division Rhodia

Mr J.-F. BAUMARD, Scientific Advisor, INC CNRS

Mr J.-R. PUIGGALI, vice-President of University of Bordeaux 1

Report

1 • Introduction

- Date and execution of the visit

The evaluation committee met in Bordeaux from 3-5 November 2009. A brief meeting to organize the evaluation took place on the night of 3 Nov. The committee convened at the LOF laboratory on 4 Nov., heard presentations from the Director and the leaders of the three scientific projects, and toured the laboratories. There were separate meetings with the permanent members of Unity and with the students and Postdocs. The evaluation and much of the report were accomplished on the morning of 5 Nov.

- History and geographical localization of the research unit, and brief presentation of its field and scientific activities

The laboratory of the Future is a joint research unit between Rhodia, the CNRS and the University of Bordeaux-1. Created in 2005, its research has focused on soft matter science and particularly on microfluidics, and it has achieved an international reputation in these areas. Its aim has been to develop tools, technologies and approaches at the interface of industry and fundamental science and engineering.

- Management team

The management team consists of one director (Director of Research at Rhodia), one scientific advisor (Professor at the University of Bordeaux 1), two administrators and the leaders of the three scientific projects.

- Staff members

	Past	Future
N1: Number of researchers with teaching duties (Form 2.1 of the application file)	2	2
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	3	3
N3: Number of other researchers (Forms 2.2 and 2.4 of the application file)	9	8
N4: Number engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	0,5	0,5
N5: Number engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file)	6	2
N6: Number of Ph.D. students (Form 2.7 of the application file)	9	3
N7: Number of staff members with a HDR or a similar grade	3	3

2 • Overall appreciation on the research unit

LOF is a laboratory associating researchers from CNRS, Rhodia and University of Bordeaux 1. It is a World Class laboratory in which applied and basic research themes are developed. Its aim is to enable the wide use of fluidics and robotics as standard laboratory techniques in basic science and technology and to develop new techniques and processes in microfluidics and innovative millifluidics.

This research unit has made major contributions in the areas of :

- mixing, droplet formation and breakup in microfluidics
- basic physics of non-Newtonian fluids
- high throughput experiments
- rheology, nucleation and growth, soft matter physics in confined geometries

- Strengths and opportunities
  - expertise in fluidics and soft matter physics
  - interplay and feedback between basic science and technology
  - esprit de corps, researchers feel they are in unique environment
  - international collaborations with top researchers in field
  - connection with other Rhodia labs and businesses
  - management well connected with researchers

- Weaknesses and threats
  - continuity in projects and personnel
  - economic situation (relies on the economic health of Rhodia)
  - lack expertise in simulations which should be an important part of future research

- Recommendations to the head of the research unit
  - needs innovative way to incorporate continued involvement of top academic personnel
  - a more active promotion of the group in the outside community especially in terms of nominations for invited talks at major international meetings
  - the committee supports adding a senior chemical engineer

- Production results

(cf. http://www.aeres-evaluation.fr/IMG/pdf/Criteres_Identification_Ensgts-Chercheurs.pdf)

A1: Number of lab members among permanent researchers with or without teaching duties who are active in research (recorded in N1 and N2)	5
A2: Number of lab members among permanent researchers with or without teaching duties who are active in research (recorded in N3, N4 and N5)	1
A3: Ratio of members who are active in research among staff members [A1/(N1+N2)]	100%
A4: Number of HDR granted during the past 4 years	1
A5: Number of PhD granted during the past 4 years	7
A6: Other relevant item in the field	

3 • Specific comments

- Appreciation on the results

LOF is a major world player in the field of microfluidics and an innovator in the important areas of high throughput experimentation using fluidics and robotics. They will play a major role in inculcating this culture in research labs internationally.

There have been 76 publications in major scientific and technological journals over the past 4 years. Many of these are in high citation journals and have been well received and cited by the scientific community. Seven PhD thesis' have been completed and the students have obtained research positions in major laboratories. There have been 14 national and international patents granted.

There have been extensive collaborations and publications with some of the world leading scientists and groups nationally and internationally. Several of these are continuing. There is extensive collaboration and partnerships with other units of Rhodia which appear extremely beneficial to all parties.

- Appreciation on the impact, the attractiveness of the research unit and of the quality of its links with international, national and local partners

One Professor of the LOF has been elected a member of the IUF. There have been 4 PhD prizes. There have been 15 invited talks at international conferences and national workshops.

Suggestion : management should be aware of major international conferences and keep in contact with conference organizers. Forefront research should be brought to their attention and group members should be nominated for invited talks.

There are many collaborations, and contacts with world leading researchers in France and internationally. There are also international visitors from Rhodia and from Universities. However, the students and postdocs are largely local. The laboratory has been quite successful in competing for and obtaining funding locally, nationally and in the European community. e.g. 3 BQR projects, 4 Aquitaine projects, 4 ANR projects and 2 European projects.

LOF is well connected with the international leaders in the field of microfluidics, fluidics and soft matter physics. LOF has demonstrated that high throughput data acquisition and analysis is an effective way to approach many fundamental and industrial research problems. This philosophy has caught on in many research labs in general and the particular techniques have been successfully transferred to other branches of Rhodia. There have also been major scientific and technological advances in fluidics.

- Appreciation on the strategy, management and life of the research unit

The management is well regarded and in contact with the researchers who appear to enjoy the unique atmosphere of the laboratory. There is a good balance and synergy between the basic research and the industrial goals of Rhodia.

Although the laboratory is strongly connected with Rhodia, the researchers feel completely free to pursue the science in which they are interested. In fact the industrial connection and directed projects motivate fundamental questions which are then pursued. Recent research in fluidics at the milli-fluidic scale is particularly « cutting edge » in treating flows at moderate Reynold's number.

There is an extensive teaching and training program run by LOF. There are two researchers who teach in the Chemistry department of the university, and nine researchers teach microfluidics at various schools and summer schools. There have been 7 PhD's and 12 postdocs. There have also been 121 training periods largely for undergraduates from major schools throughout France.

- Appreciation on the project

The project for the next four years seems entirely feasible and justified as an outgrowth of the research performed in microfluidics and millifluidics over the past 4 year period. The tools, techniques and materials have been developed and now they are to be put to use in some specific areas. The reorganization of the research units, their new leaders and the resources are appropriate.

The new projects aim to follow through on the ideas of high throughput research (or high throughput screening, HTS), fluidics and robotics, in specific areas. It will be particularly interesting to see whether these LOF developed techniques can successfully find solutions to the specific problem of finding an effective surface tension reducer for enhanced oil recovery. This is an experiment in how effective HTS is in answering a well-defined question. There is also breakthrough science to be tackled in medium Reynold's number flow, rheology, new materials, and mini reactors for chemistry.

4 • Appreciation team by team and/or project by project projet :

Title of the team : Complex Fluids (previously Control and Management of Flows in Microfluidic Devices)

Name of the team leader : Mrs Annie COLIN

	Past	Future
N1: Number of researchers with teaching duties (Form 2.1 of the application file)		2
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)		0
N3: Number of other researchers (Form 2.2 and 2.4 of the application file)		2
N4: Number engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)		1
N5: Number engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file)		0
N6: Number of Ph.D. students (Form 2.7 of the application file)		4
N7: Number of staff members with a HDR or a similar grade		1

- Appreciation on the results

The project *Control and Management of Flows in Microfluidic Devices* has largely focused on developing microfluidic devices to study and control the production and flow of droplets in immiscible carrier oils in microfluidic devices. The twin objectives of this work were to better undertand the flow of complex fluids in porous media and to allow droplets in microfluidic systems to be easily made and manipulated in a highly controlled fashion with a view to using them as independent microreactors.

The way that the Rayleigh Plateau instability controls the formation of droplets or parallel flows in microfluidic devices has been studied in detail, with excellent agreement between the experimental and theoretical results. The flow of droplets in microfluidic networks has also been studied. This can be complex due to the hydrodynamic feedback of droplets in different outlets at a junction. It was found that droplets choose their path in order to maximize the total flow rate and devices with shunts after the junction were developed to induce perfect alternating distribution of droplets between two outlets. Thus, two critical components of droplet-based microfluidic systems are now understood in detail and well controlled.

A simple microfluidic rheometer, based on using parallel flows as a pressure sensor, was developed, and microfluidic devices were also used to perform rheological measurements to study the flow of complex fluids in confined geometry. Particle image velocimetry (PIV), which involves using a CCD camera to monitor the flow of fluorescent particles seeded in the fluid, was used to extract local flow curves from the microfluidic experiments and used to study flow of wormlike micellar systems. It was found that there is no universal local relationship between stress and shear rate. Similar studies of soft glassy materials in microfluidic systems (using PIV) and in a Couette cell (using NMR) showed that in the jammed state, there is no universal relationship between local shear stress and local shear rate. A theoretical model was proposed to explain this extremely interesting behaviour. This work beautifully illustrates how microfluidic systems can be used to gain profound insights into the behaviour of complex fluids. This work is world class.

The quality of the 18 publications arising directly from this project is, on average, very high, and published in extremely good journals (including one publication in Science, one in Nature and eight in Physical Review Letters) representing an extremely good output. The exposure at international conferences, notably for invited talks could however, be improved, and does not seem to adequately reflect the high level of the research.

- Appreciation on the impact, the attractiveness of the team and of the quality of its links with international, national and local partners

The team has developed links with some extremely strong national and international collaborators at ESPCI, Paris, Harvard University, USA and (Princeton University, USA). These collaborations have been extremely productive and a large number of co-authored papers with the collaborators have been published. Furthermore, some of the microfluidic techniques developed by the group, e.g. droplet formation and sorting, are now being implemented by Rhodia teams for routine analysis both at LOF and other Rhodia sites.

- Appreciation on the project

The four year project, *Control and Management of Complex Fluids at the Micronic Scale*, is directly linked to a strategic project for Rhodia dealing with Enhanced Oil Recovery (EOR). The aim is, on the one hand, to use robotic and microfluidic techniques developed at LOF to screen EOR surfactants and on the other hand to use robotic and microfluidic techniques to investigate the fundamental processes controlling chemical EOR. In fact, the injection of low interfacial tension formulations in water wet reservoirs is well understood, hence the main potential benefit of this project relies on the efficient combinatorial screening of EOR surfactants using the robotic and microfluidic systems developed.

In contrast, the very low capillary number regime typical of heterogeneous oil wet reservoirs is not fully understood and here there is considerable scope to gain important new fundamental insights into these systems. Specifically, the project aims to address: (1) the flow of complex fluids in a defined geometry when using wormlike micelles and emulsions; (2) the flow of immiscible liquids at very low capillary numbers to help address issues in oil wet reservoirs, and (3), to study flow in model, microfabricated, porous media. Various aspects of these processes are not fully understood and the innovative use of microfluidic (and potentially also nanofluidic) techniques proposed should provide a powerful tool to study them.

The likelihood of success of the project is greatly enhanced by the collaboration with Princeton University Professor who is an expert on wetting. The idea of developing an integrated project, which will use the microfluidics expertise of the team to tackle such an important strategic project is very attractive: the structure of the research group should potentially allow fundamental insights developed using microfluidic systems to be translated into EOR strategies which can be tested on core samples and ultimately in the field. It appears to be the first time that a group in LOF has tackled a big Rhodia project like this in such a coordinated way and, if successful, it would serve to strongly validate the microfluidic expertise developed at LOF.

- Conclusion:

This is a world class microfluidics group which has specialised in understanding the flow of complex fluids using microfluidic systems. They have made fundamental insights into the flow of complex liquids in porous media and in understanding the production and manipulation of droplets in microfluidic systems (with the aim of using the droplets as microreactors). The project for the next four years builds beautifully on this work, aiming to use microfluidic (but also robotic) systems to study flow of complex fluids in confined geometry for enhanced oil recovery (EOR). The structure of the project team should allow fundamental insights to be translated into EOR strategies which can be tested on core samples and ultimately in the field. If successful, it would serve to strongly validate the microfluidic expertise developed at LOF.

- Strengths and opportunities:

World class expertise in studying flow in confined systems using microfluidics.

Good combination of the experimental and theoretical parts.

The collaboration with Rhodia should allow this expertise to be translated into new strategies for EOR which can be tested.

Excellence in research themes and publication level

- Weaknesses and threats:

The main threat would be if the team leader was to leave before the end of the next four years. This is a risk as there seems to be a possibility that microfluidic activities at LOF will not continue in four years time, forcing the current microfluidics team to seek other opportunities and perhaps not to stay with the project for the full four years.

- Recommendations

The group should continue to be strongly supported and a solution should be found to keep the team together for the next four years (or at the very least keep the senior members actively involved in the project after they leave).

Title of the team : Shaping of Soft Condensed Matter to Design Functional Materials (Previously two projects – ``A Continuous Approach to the Dynamics of Out of Equilibrium Systems'' and ``Instrumentation, MicroTechnologies, MicroAnalysis, Automation")

Name of the team leader : Mr J. LENG / Mr J.B. SALMON

	Past	Future
N1: Number of researchers with teaching duties (Form 2.1 of the application file)		0
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)		2
N3: Number of other researchers (Form 2.2 and 2.4 of the application file)		2
N4: Number engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)		0
N5: Number engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file)		0
N6: Number of Ph.D. students (Form 2.7 of the application file)		5
N7: Number of staff members with a HDR or a similar grade		1

- Appreciation on the results

The team developed several microfluidic tools to study the chemistry and physical chemistry of fluids. A strength of the team approach is to design tools that allow for the direct measurement of structural properties: birefringence under optical microscopy, X-ray scattering, UV-spectroscopy…

The team has published in major journals. Altogether 32 papers have been published. The results have been extensively presented in international conferences, with a few invited lectures. 2 Ph.D thesis have been defended and the team recruited 5 Ph.D. students and 2 postdocts. Innovation transfer issued from the team's research has been well protected by numerous patents…

- Appreciation on the impact, the attractiveness of the team and of the quality of its links with international, national and local partners

The team has several local collaborations and participated in one national program funded by ANR.

- Appreciation on the project

The team proposes using and developing microtools to design, assemble and study the genesis of materials at the micron scale. The project is segmented and it deserves a clearer identification of the key challenges.

- Conclusion:

A good team of young scientists performing careful fundamental research and high-level technological developments in microfluidics, well connected and inspired by Rhodia activities.

- Strengths and opportunities :

✓ A strong expertise in microfluidic technology.

✓ A careful approach to the design of the devices and a deep interpretation of the results.

✓ A close connection with the other teams.

- Weaknesses and threats :

Leadership not clearly identified.

- Recommendations :

The team needs to build a middle to long-term vision of its scientific objectives. The team would benefit from the presence of a senior scientist of well-established international reputation.

Title of the team : Microchemistry

Name of the team leader : Mr E. MIGNARD

	Past	Future
N1: Number of researchers with teaching duties (Form 2.1 of the application file)		0
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)		2
N3: Number of other researchers (Form 2.2 and 2.4 of the application file)		1
N4: Number engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)		0
N5: Number engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file)		0
N6: Number of Ph.D. students (Form 2.7 of the application file)		4
N7: Number of staff members with a HDR or a similar grade		0

- Appreciation on the results

The committee only evaluated the project and not the earlier activity since it is a new team created in 2008.

- Appreciation on the impact, the attractiveness of the team and of the quality of its links with international, national and local partners

The team has several local collaborations and participated in a large program funded by Aquitaine Région.

- Appreciation on the project

The project aims at using the strong experience acquired by LOF during the past 4 years regarding the development of micro- and millifluidic systems to investigate chemistry. The project has two main parts: Radical Chain Polymerization in Microreactors and Supercritical Microfluidics.

The first part corresponds to a study of radical chain polymerization applied to distinct hydrophilic monomers under various conditions in order to obtain copolymerization kinetics and revisit determination of reactivity ratios. The use of droplets in liquid/liquid biphasic systems as millireactors is the key novelty here, allowing for the monitoring of chemical compositions in real time by the mean of non-intrusive analytical systems. Care must be exerted however in the definition of the work plan to demonstrate that changes in reactivity ratios can indeed be expected from the use of millifluidic tools.

The second component of the project aims at combining supercritical fluids, as supercritical CO_2, with micro- and millifluidics. It plans using supercritical fluids in micro- and milli-fluidic systems as reactant fluid carriers in polymeric or hybrid material synthesis. This sub-project is more fundamental than the first from a physical point of view. From a chemical point of view the project is restricted to the investigation of the polymerization mechanisms with monomers bearing fluorinated or siloxane groups, the connection with green chemistry being therefore difficult to establish.

- Conclusion :

  - Strengths and opportunities

Uses expertise developed in this lab in fluidics and supercritical fluids.

  - Weaknesses and threats

Industrial relevance unclear for specific projects identified

  - Recommendations

The committee would recommend to the Microchemistry team to develop a more clearly focused project with better defined scientific objectives, perhaps focusing on the accumulation of basic data to better understand the fundamental processes for polyamide intermediate synthesis.

Laboratoire du Futur UMR 5258 (LOF)

Note de l'unité	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
A	A+	A	A+	A

Nom de l'équipe : Complexe Fluids

Note de l'équipe	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
A+	A+	A	non noté	A+

Nom de l'équipe : Fonctional materials

Note de l'équipe	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
A	A	A	non noté	A

Nom de l'équipe : Micro-chemistry

Note de l'équipe	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
non noté	non noté	non noté	non noté	B

Avec mes collègues du Laboratoire, nous avons pris connaissance de ce rapport avec la plus grande attention. Nous apprécions évidemment l'avis positif donné sur l'Unité et son positionnement comme un Laboratoire de niveau mondial, ce qui récompense les efforts effectués par tous les membres de l'Unité pour l'amener en quelques années d'un projet partagé par Rhodia, le CNRS et l'Université de Bordeaux 1, à une réalité validée par nos pairs. Nous prenons note de la bonne évaluation de la qualité de la recherche effectuée dans notre laboratoire, et de la visibilité de la coordination et de la complémentarité entre les projets académiques et les projets industriels.

Pour autant nous intégrons aussi les remarques et recommandations formulées, et nous en tiendrons compte dans le but d'améliorer encore les résultats de notre laboratoire et le fonctionnement de nos équipes.

Je formule ci-dessous les commentaires aux principales observations faites dans le rapport :

- **les craintes sur le départ du senior de l'équipe fluidique (ou d'autres académiques d'ailleurs)** : la présence de gens de qualité dans des équipes implique forcément le risque (ou l'opportunité pour eux !) qu'ils fassent l'objet de propositions externes. Dans le cas précis, nous assumons ce risque et partageons régulièrement avec l'intéressée, par ailleurs en charge de la structuration d'une fédération de la matière molle sur le site bordelais, ce qui nous semble une garantie minimum de pérennité sur le site. Si malgré tout un départ intervenait, la thématique survivrait, car elle est clé pour le laboratoire, et le contact scientifique entre nous resterait. L'affaiblissement conséquent au départ serait compensé par un recrutement au meilleur niveau sur la même thématique. De manière plus générale, les thématiques Rhodia et les équipes (académiques et Rhodia) seront maintenues au plan quantitatif et qualitatif durant le quadriennal quels que soient les choix personnels d'évolution des membres du laboratoire. Rhodia a clairement exprimé son engagement sur la durée du quadriennal.

- **le besoin en modélisation** : nous sommes conscients de notre manque relatif dans le domaine. Nous avons cependant eu des contacts réguliers avec l'Institut de Mathématiques de Bordeaux durant le quadriennal précédent. Par ailleurs une collaboration sur ce thème est en cours de mise en place via Rhodia avec un institut à la réputation affirmée dans le domaine (qui ne peut être cité pour l'instant), nous avons déposé un projet commun avec l'INRIA (modélisation du comportement de fluides viscoélastiques pour la récupération assistée du pétrole), et Rhodia a embauché au 1/1/2010 pour l'Unité une spécialiste de modélisation en chimie, formée par un post-doc à l'Université d'Amsterdam. Nous devrions donc trouver rapidement un niveau raisonnable dans le domaine.

- **l'équipe mise en forme des matériaux** : le leadership dans cette équipe encore récente et composée de deux jeunes chercheurs de grande qualité n'est volontairement pas identifié, et se dessinera naturellement avec le temps. Nous avons probablement mal présenté les objectifs de cette équipe, en axant trop la présentation sur les Matériaux. La réalité est que les travaux sont clairement axés sur la compréhension de phénomènes complexes entrant en jeu dans la mise en forme de matériaux, en utilisant la spécificité des outils de fluidique développés par l'équipe. Nous travaillons par exemple la recherche de l'identification des étapes clés dans le séchage d'une dispersion, et l'impact sur la nature (morphologie, organisation) du composé obtenu. Cette équipe va travailler avec les équipes de Rhodia sur l'amont de sujets définis en commun : étude du séchage des gâteaux de silice, organisation de matériaux luminescents à l'échelle sub-micronique.

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A noter aussi que cette équipe est intégrée dans le projet européen METACHEM dans lequel elle cherche à comprendre comment contrôler la mésostructure des matériaux pour accéder aux modulations de propriétés attendues Nous avons bien noté l'intérêt de l'apport d'un senior (sous une forme à définir) pour appuyer la vision moyen – long terme de cette équipe et nous allons travailler sur les solutions possibles.

- **l'équipe microchimie** : nous notons ici un malentendu entre ce que nous avons présenté (probablement de manière insuffisamment précise) et les conclusions des auditeurs. L'équipe a défini son projet sur l'intérêt de l'apport de la millifluidique pour guider la synthèse de polymères par une chimie dans l'eau (accès à de nouveaux copolymères, contrôle des masses et des polydispersités par exemple), en étroite discussion avec les équipes de Rhodia. Elle n'envisage pas du tout l'utilisation de monomères fluorés ou siliconés, mais est bien guidée par l'impact industriel de ses travaux, les polymères de spécialité et la polymérisation radicalaire constituant une des technologies importantes de Rhodia. Des modifications dans les rapports de réactivité peuvent être réellement attendues de l'outil millifluidique, qui permet en effet de travailler dans des conditions de concentration très difficilement mises en œuvre dans des réacteurs "batch" de dimensions usuelles. Les coefficients de vitesse de propagation peuvent varier fortement selon les conditions de solvatation des comonomères et ainsi avoir un effet sur les rapports de réactivités.
Enfin l'activité exploratoire « fluides supercritiques » sera mise à profit, outre les études fondamentales de l'équipe, pour étudier les synthèses de polymères dont le polyamide ou de produits minéraux dans des conditions extrêmes et en tirer des informations utiles pour les procédés du futur. Il y a donc bien une bonne intégration des problèmes industriels dans l'activité de cette jeune équipe. Nous travaillons également avec l'Université sur le recrutement d'un expert en Génie de la réaction aux petites échelles, ce qui correspond bien à la recommandation du Comité.

Enfin quelques précisions sur des commentaires secondaires mais que nous prenons également en compte :

- **les étudiants sont généralement « locaux »** : tout dépend ce que l'on entend par « local », mais sur 12 thésards et post-docs, nous avons 2 étrangers, et 8 (soit les 2/3 !) ont effectué leurs études de second cycle en dehors de Bordeaux. Nous sommes parfaitement d'accord sur l'importance de la diversité pour les étudiants en thèse dans le laboratoire et cherchons constamment à diversifier les origines de nos thésards et post-docs.

- **visibilité dans les congrès** : le directeur prend bonne note de l'importance de mieux promouvoir les travaux de nos équipes. Et même si nos chercheurs sont déjà régulièrement invités dans des congrès de bon niveau, ainsi qu'exprimé dans le rapport (15 conférences invitées pour 8 chercheurs), le directeur accordera une attention particulière à ce point. Nous prévoyons d'ailleurs d'organiser sur Pessac en 2011 un colloque scientifique sur la matière molle et la fluidique, dans le cadre du réseau européen auquel lequel nous participons sur ce thème (COMPLOIDS).

Le Directeur du LOF
Docteur Patrick MAESTRO

Le Président de l'Université Bordeaux 1
Professeur Alain BOUDOU

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