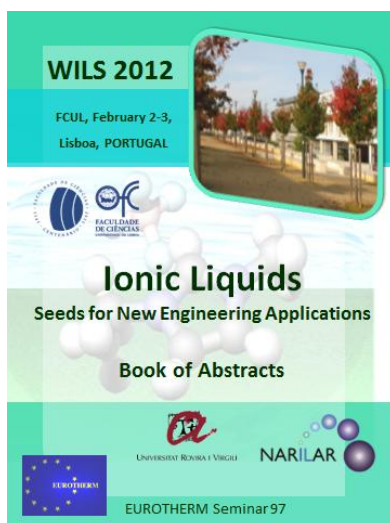




International Workshop on
Ionic Liquids - Seeds for New Engineering Applications

WILS 2012 – Faculdade de Ciências da Universidade de Lisboa, Lisbon,
Portugal, 2-3 February 2012



Scientific Report

April 2012

1. Introduction

On the occasion of the Commemoration of the Centenary of Faculdade de Ciências da Universidade de Lisboa (FCUL, established by decree of 19th April 1911) and on the advent of several major modifications in energy utilization and recovery, the Center for Molecular Sciences and Materials of the Department of Chemistry and Biochemistry of FCUL in collaboration with the CREVER - Grup d'Investigació d'Enginyeria Tèrmica Aplicada, Department of Mechanical Engineering, Universitat Rovira i Virgili, Tarragona, Spain, decided to jointly promote this international workshop (WILS2012) on the potential applications of Ionic Liquids (ILs) and their mixtures with other solvents and nanomaterials in two very important areas: Absorption refrigeration and heat pumps and New heat transfer fluids.

This workshop was an event of the European Marie Curie Action NARILAR - New Working Fluids based on Natural Refrigerants and Ionic Liquids for Absorption Refrigeration and is also recognized as Eurotherm Seminar 97. The aim of EURO THERM is to promote and foster European cooperation in Thermal Sciences and Heat Transfer by gathering together scientists and engineers working in specialized areas (<http://www.eurothermcommittee.eu>).

The aim of the workshop was to bring together researchers working on ILs, heat transfer fluids, and nanomaterials as well as company people producing and supplying ILs and to discuss on possible working fluids, particularly ILs for heat transfer applications, their economic viability and technical challenges. Related industries were invited to participate in the workshop for potential discussions and collaborations. The workshop will feature motivation and plenary talks from internationally recognized academic and industrial experts in the field followed by presentations of contributed papers and posters.

It was organized as part of the NARILAR Project - New Working Fluids based on Natural Refrigerants and Ionic Liquids for Absorption Refrigeration (FP7-PEOPLE-2010-IRSES (MARIE CURIE ACTIONS), with Universitat Rovira i Virgili, Tarragona, Spain (Alberto Coronas), University of Lisbon (Carlos Nieto de Castro), National Chemistry Laboratory, Pune (Anil Kumar) and Indian Institute of Technology Madras, Chennai (G. Venkatarathnam), India.

The workshop was held on the campus of Faculdade de Ciências da Universidade de Lisboa (FCUL), Campo Grande, 1749-016 Lisbon, Portugal, in buildings C1 and C6.

FCUL, 5 of April 2012,

The Organizing Committee

2. Organization

Organizing Committee:

Carlos Nieto de Castro (CCMM-FCUL, Portugal, cacastro@fc.ul.pt, Tel. +351 217 500918) - Chairman

Alberto Coronas (CREVER-URV, Spain, acoronas@etseq.urv.es, Tel. +34 977 559665) – Co-Chairman

S. M. Sohel Murshed (CCMM-FCUL, Portugal, smmurshed@fc.ul.pt, Tel. +351 217 500216) - Secretary

Daniel Salavera (CREVER-URV, Spain, daniel.salavera@urv.cat ; Tel. +34 977 558613

Luís Paulo N. Rebelo (ITQB-UNL, Portugal, lrebelo@itqb.unl.pt ; Tel. +351 214 469 100

Maria J. V. Lourenço (CCMM-FCUL, Portugal, mjlourenco@fc.ul.pt; Tel. +351 217 500917

Joan Carles Bruno (CREVER-URV, Spain, juancarlos.bruno@urv.cat; Tel. +34 977 257068

Fernando J. V. Santos (CCMM-FCUL, Portugal, fisantos@fc.ul.pt; Tel. +351 217 500919

Workshop topics included: ILs as heat transfer fluids, Application of ILs in absorption refrigeration and heat pumps, Commercialized applications of ILs and Nano and Ionano-fluids as advanced coolants. The submitted papers were organized in the following sessions:

Session 1 – Invited Lectures (Academic)

Session 2 – Oral Presentations - Ionic Liquids-Synthesis and Characterization

Session 3 – Oral Presentations - Ionic Liquids and Absorption Refrigeration

Session 4 – Poster Presentations

Session 5 – Talk on NARILAR Project

Session 6 – Invited Lectures (Industry)

Session 7 – Oral Presentations - Ionic Liquid–Processes and Heat Transfer

Session 8 – Poster Presentations

Session 9 – Panel discussions

Session 10 – Reports from working groups and discussion

The detailed programme is described in Annex 1. The workshop site was <http://www.dqb.fc.ul.pt/wils2012/index.php>. The e-mail was wils2012@fc.ul.pt. There were 18 selected oral communications, 40 posters and 7 invited talks, from academia and industry.

The invited talks were:

- 1) John D Holbrey (Senior Research Fellow, QUILL, The Queen's University of Belfast, UK) - Developing new ionic liquid formulations for energy applications
- 2) Alberto Coronas (Professor, Director CREVER-URV, Spain) - Towards the next generation of absorption heat pumps
- 3) Carlos Nieto de Castro (Professor, Director CCMM, FCUL, Portugal) - Ionanofluids – Will they be useful?

- 4) Klemens Massonne (BASF SE, Ludwigshafen, Germany) - Ionic Liquids at BASF SE: introduction and technical applications
- 5) Matthias Seiler (Evonik Industries AG, Hanau, Germany) - Industrial Progress: A new generation of commercially available working fluids for absorption chillers and heat pumps
- 6) Thomas J. S. Schubert (Io-Li-Tec, Ionic Liquids Technologies GmbH, Germany) - Brief overview about sorption media and thermal fluids
- 7) Luís Branco (Solchemar Lda., Portugal) - Ionic liquids from Solchemar as functional organic materials

3. Participation

Opening Session: Vice-Rector, Prof. Teresa Cid, in representation of the Rector of the university of Lisbon, Vice-Director of FCUL, Prof. António Sá Fonseca, President of SPQ, Prof. Mário Berberan Santos, Chairman, Prof. Carlos Nieto de Castro and Co-Chairman Prof. Alberto Coronas

The participation was very good, about 70 participants, many students, mostly from Portugal, Spain and Germany. The response of the invited lecturers from academia and industry was perfect.

From the chairman opening address:

“ ... Today we must pay the tribute to a fantastic chemist but also an excellent problem solving in industrial chemistry – Dmitri Ivanovitch Mendeleev, died on 2 of February 1907, exactly 105 years ago... He 1901 he wrote (citation):

...We could live at the present day without a Plato, but a double number of Newtons is required to discover the secrets of nature, and to bring life into harmony with the laws of nature...Let's try to discover the secrets of nature. I hope that tomorrow, when we close the WS, we can find us richer (scientific and social), paving the way for partnerships and developing new products.” (2-2-2012)

Closing Session: Director of FCUL, Prof. José Pinto Paixão, Prof. Carlos Nieto de Castro and Co-Chairman Prof. Alberto Coronas

The main conclusions of the workshop are reported below (see section 6) and the Best Poster of the two poster presentation sessions selected by a Selection Committee composed by Prof. Luis Santos (FCUP, Portugal), Prof^a. Maria José Lourenço (FCUL, Portugal) and Prof^a. Maria Isabel Lampreia (FCUL, Portugal) were presented. The awards were given to:

PPD1-07 Encapsulated ionic liquids (EIL): from continue to discrete fluid for enhancing transport phenomena kinetics in separation and reaction applications, J. Lemus, J. Palomar, N. Alonso, J. Bedia, M.A. Gilarranz, and J.J. Rodriguez (Universidad Autónoma de Madrid, Spain)

PPD2-25 Liquid-Liquid equilibria and transport studies of ternary systems composed of ionic liquid, 1-hexanethiol and n-dodecane, A.R. Ferreira, M.G. Freire, L.A. Neves, J.C. Ribeiro, F.M. Lopes, J.G. Crespo and J.A.P. Coutinho (University of Aveiro , Universidade Nova de Lisboa and Galp Energia, Portugal)

4. Sponsorship

Institutional Partners: Centro de Ciências Moleculares, FCUL, CREVER - Grup d'Investigació d'Enginyeria Tèrmica Aplicada, Universitat Rovira i Virgili, Tarragona, Spain, Instituto de Tecnologia Química e Biológica, Universidade Nova de Lisboa, Portugal, Portuguese Chemical Society (commemorating also its 100th anniversary with the International Year of Chemistry), The Department of Economy and Knowledge of Catalonia, Spain, Fundação para a Ciência e a Tecnologia, Portugal, and Eurotherm Committee.

Companies: EVONIK Industries, Germany and BASF Portugal.

Management Support: Fundação da Faculdade de Ciências da Universidade de Lisboa and Terranova (Travel Agency).

The workshop dinner, held at “Churrasqueira do Campo Grande” Restaurant (2/2/2012), was sponsored by BASF Portugal.

Please see logos in Annex 2.

5. Publications

The following publications were made at the date of the conference:

- Website (<http://www.dqb.fc.ul.pt/wils2012/index.php>) (Annex 3)
- Leaflet to announce the conference (Annex 4)
- Poster to announce the Conference (Annex 5)
- Book of Abstracts, with all the information or the participants (Annex 6)
- CDROM, with all the information or the participants
- Video by SPUL, in portuguese (<http://youtu.be/WNP14OJg6yY>) and english (<http://youtu.be/5m5kRK4dPK4>)
- TV Coverage by RTP2 – COM CIÊNCIA (22-2-2012), (from the beginning to 7 minutes) http://tv1.rtp.pt/programas-rtp/index.php?p_id=26914&c_id=8&dif=tv&idpod=72647
- TV Coverage by RTP2 –2 – Universidade Aberta (Prog 35, 29-2-2012), (from 14:42 to 20:00) <http://vimeo.com/channels/tfuab#37586088>
- Photos (<http://www.dqb.fc.ul.pt/wils2012/media.php>) – a group photo is shown in annex 7

6. Conclusions

The conclusions of the workshop can be summarized in the following items:

- Excellent oral presentations, that allowed discussions and learning about the main problems the conference topics opened
- A wide variety of posters, many of excellent quality, that promoted informal contacts and discussions among the participants
- On the technical side, there were several recommendations, related with the use/choice of ionic liquids in several applications, their long term stability and corrosiveness, their cost (expected to decrease significantly when industrial production develop (a thumb value of 20 €/kg is expected)
- In addition of their possible application as heat transfer and storage fluids, well recognized, namely with Ionanofluids (low nanomaterial content), application as lubricants was stressed. Low viscosity systems are a target, and in many applications, if corrosiveness is protected, systems IL+water are recommended
- Application in absorption refrigeration of ionic liquid systems with water, carbon dioxide and ammonia were discussed, the pros and cons of its use in chillers and heat pumps (retrofitting might be a problem), and a cost/benefit analysis has to be performed. Here new environmental legislation (incentives to manufacturers can favour these applications)
- Ammonia was recommended to replace, because the toxicity problem is still an open question
- Regarding the synthesis of ionic liquids, the participants recommended to keep as open as possible, not limiting the anions and cations used
- The use of mixture combinations and additives, in industrial applications will resolve many of these problems. If there are economic and technical advantages for the use of this ionic liquid systems in engineering applications, all the other problems will be resolved in a near future
- The Narilar committee decided to organize a further meeting WILS2013, on the occasion of COIL-5 (<http://coil-5.itqb.unl.pt>), April 21-25, 2013, Vilamoura, Algarve, Portugal

Annex 1 – Detailed programme

WILS2012 PROGRAM AT A GLANCE

Time	February 1, 2012 (Wednesday)	February 2, 2012 (Thursday)	February 3, 2012 (Friday)
8:30-9:00		Registration (Bldg C6, Level 2, LT 6.2.53 Lobby)	Registration (Bldg C1, Level 3, Northeast side Lobby)
9:00-9:20		Opening the workshop (Bldg C6, LT 6.2.53)	Session 5: Talk on NARILAR Project (Bldg C1, LT 1.3.14)
9:20-11:00		Session 1: Invited Lectures- Academic (Bldg C6, LT 6.2.53)	Session 6: Invited Lectures- Industry (Bldg C1, LT 1.3.14)
11:00–11:30		Coffee Break	Coffee Break
11:30–13:30		Session 2: Oral Presentations ¹ (Bldg C6, LT 6.2.53)	Session 7: Oral Presentations ³ (Bldg C1, LT 1.3.14)
13:30–15:00		Lunch and informal contacts (Bldg C6, Restaurant)	Lunch and informal contacts (Bldg C6, Restaurant)
15:00-16:00		Session 3: Oral Presentations ² (Bldg C6, LT 6.2.53)	Session 8: Poster Presentations (Bldg C6, Level 1, North side Lobby)
16:00-17:00			Session 9: Panel discussion- Working Groups 1 and 2 (Bldg C1, LT 1.3.14 & 1.3.15)
17:00-18:00	Registration and Welcome reception (Bldg C6, Level 1, Restaurant Lobby)	Session 4: Poster Presentations (+Coffee) (Bldg C6, Level 1, North side Lobby)	Session 10: Reports from Working Groups and Discussion(+Coffee) (Bldg C1, LT 1.3.14)
18:00-18:30			Closing remarks and Way Forward (Bldg C1, LT 1.3.14)
20:00		Workshop Dinner (Restaurant: Churrasqueira do Campo Grande)	

¹Topic: Ionic Liquids-Synthesis and Characterization;

²Topic: Ionic Liquids and Absorption Refrigeration;

³Topic: Ionic Liquid- Processes and Heat Transfer

Note: LT 6.2.53=Lecture Theater in Building C6, Level 2, and Room 53. The same applies to other LT numbers.

WILS2012 DETAILED PROGRAM

Day 0 (Wednesday, February 1, 2012)

17:00–18:30: Registration and Welcome reception

Venue: Building C6, Level 1, Restaurant Lobby

Day 1 (Thursday, 2 February 2012)

8:30–9:00: Registration and workshop check-in

Venue: Building C6, Level 2, LT 6.2.53 Lobby

9:00–9:20: Opening the workshop (Venue: Building C6, LT 6.2.53)

9:20–11:00: Session 1–Invited Lectures (Academic)

Chair: Luís Rebelo (ITQB, Portugal)

Venue: Building C6, LT 6.2.53

- 1.1 Developing new ionic liquid formulations for energy applications, *John D. Holbrey* (Senior Research Fellow, QUILL, The Queen's University of Belfast, UK)
- 1.2 Towards the next generation of absorption heat pumps, *Alberto Coronas* (Director CREVER-University Rovira I Virgili, Tarragona, Spain)
- 1.3 Ionanofluids– Will they be useful?, *Carlos Nieto de Castro* (Director CCMM, Faculty of Sciences, University of Lisbon, Portugal)
- 1.4 Methods to improve the efficiency of ionic liquids, *Anil Kumar* (Senior Researcher, National Chemistry Laboratory, Pune, India)

11:00–11:30: Coffee Break

11:30–13:30: Session 2 – Oral Presentations (contributed papers)

Topic: Ionic Liquids-Synthesis and Characterization

Chair: Eduarda Araújo (FCUL, Portugal) and João Fareleira (IST, Portugal)

Venue: Building C6, LT 6.2.53

- 2.1 Interactions of ionic liquids with metals: friction at surfaces and solvation of nanoparticles, *A.A.H. Pádug*, (Université Blaise Pascal Clermont-Ferrand, France)
- 2.2 Thermophysical property research on ionic liquids at the Erlangen graduate school in advanced optical technologies (SAOT), *M.H. Rausch, A. Leipertz and A.P. Fröba* (Erlangen Graduate School in Advanced Optical Technologies (SAOT), Erlangen, Germany)
- 2.3 Temperature dependence of electrolytic conductivity for some room temperature ionic liquids, *M.S. Calado, J.C. F. Diogo, J.L. Correia da Mata, F.J.P. Caetano, Z.P. Visak and J.M.N.A. Fareleira* (Instituto Superior Técnico, Technical University of Lisbon, Portugal)
- 2.4 Design and synthesis of new ionic liquids for specific applications, *P. Verdía, M.Vilas, M.Mahrova, F. Santamarta and E. Tojo*, (Universidade de Vigo, Spain)
- 2.5 Thermal properties of new phosphonium-based ionic liquids with carbon nanotubes, *M.A. Fonseca, A.G.M. Ferreira, M.S.A. Oliveira and A.F. Ferreira* (University of Aveiro and University of Coimbra, Portugal)
- 2.6 Ionic liquids: toxicity assays in a cell model, *R.F.M. Frade, A.A. Rosatella, S.P. Simeonov and C.A.M. Afonso* (University of Lisbon, Technical University of Lisbon and Bulgarian Academy of Sciences, Sofia, Bulgaria)

13:30–15:00 Lunch and informal contacts (Venue: Building C6, Restaurant)

15:00–17:00: Session 3– Oral Presentations (contributed papers)

Topic: Ionic Liquids and Absorption Refrigeration

Chair: Josefa Fernandez (USC, Spain) and Joan Carles Bruno (URV, Spain)

Venue: Building C6, LT 6.2.53

- 3.1 Evaluation of several IL + TFE systems for refrigeration by absorption using

thermophysical properties, *M.R. Currás, L.M. Casás, A.A.H. Padua, J.L. Legido and J. García* (Universidad de Vigo, Spain and CNRS, Laboratoire Thermodynamique et Interactions Moléculaires, France)

- 3.2 Performance analysis of a single-effect absorption refrigeration cycle with 2,2,2-trifluoroethanol + 1-ethyl-3-methylimidazolium tetrafluoroborate and ethanol + 1-butyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imide, *D.S. Ayou, D. Salavera, M. Curras, J. García, J.C. Bruno and A. Coronas* (Universitat Rovira i Virgili and Universidad de Vigo, Spain)
- 3.3 Bubble nucleation dynamics of R-134a refrigerant in a pool boiling system, *S.M.S. Murshed and R. Kumar* (University of Lisbon, Portugal and University of Central Florida, USA)
- 3.4 A review: Solubility behaviour of natural refrigerants with ionic liquids, *T. Altamash, D. Salavera, A.Kumar, K.R. Patil, C.A. Nieto de Castro and A. Coronas* (Universitat Rovira i Virgili-Spain, National Chemical Laboratory-India and University of Lisbon-Portugal)
- 3.5 Review on the absorption heat pumps and chillers using ionic liquid as absorbents, *S.K. Swarnkar, G. Venkatarathnam, D.S. Ayou, J.C. Bruno and A. Coronas* (Indian Institute of Technology Madras, India and Universitat Rovira i Virgili, Spain)
- 3.6 How far percolation in ionic liquids is reflected in their thermophysical properties, *L. M. N. B. F. Santos, M. A. A. Rocha* (University of Porto, Portugal)

17:00–18:00: Session 4– Poster Presentations (with Coffee)

Venue: Building C6, Level 1, North side Lobby

Best Poster Selection Committee: Luis Santos (FCUP, Portugal), Maria José Lourenço (FCUL, Portugal), and Maria Isabel Lampreia (FCUL, Portugal)

Poster#

- PPD1-01 Low toxicity ionic liquids prepared from biomaterials, *W. Gouveia, M. Eduarda and M Araújo* (University of Lisbon, Portugal)
- PPD1-02 Ionic liquids as thermal fluids: feasibility study of its application on a heat exchanger of a plastic production machine, *T.I.L. Antunes, L.M.L. Mendes, C.A. Nieto de Castro and V.M.B. Nunes* (Instituto Politécnico de Tomar and University of Lisbon, Portugal)
- PPD1-03 Optimized ionic liquids for toluene absorption, *E. Ruiz, J. Bedia, V. Ferro, J. Palomar and J. J. Rodríguez* (Universidad Autónoma de Madrid, Spain)
- PPD1-04 Preparation and thermophysical characterization of [P6,6,6,14]Cl with AgI ionic liquid, *B.R. Cabo, A. Arce Jr, H. Rodríguez, E. Rodil, J.M. S. Jabardo and A. Soto* (University of Santiago de Compostela, Spain)
- PPD1-05 Preparation of CdS nanoparticles in the [P6,6,6,14][NTf2] ionic liquid, *B.R. Cabo, I. R. Palmeiro, E. Rodil, A. Soto and A. Arce* (University of Santiago de Compostela, Spain)
- PPD1-06 Economic criteria in design/selection of ionic liquids using COSMO-based process simulations. Separation of aromatic and aliphatic hydrocarbons, *V. R. Ferro, J. de Riva, D. Sanchez, E. Ruiz and J. Palomar* (Universidad Autónoma de Madrid, Spain)
- PPD1-07 Encapsulated ionic liquids (EIL): from continue to discrete fluid for enhancing transport phenomena kinetics in separation and reaction applications, *J. Lemus, J. Palomar, N. Alonso, J. Bedia, M.A. Gilarranz, and J.J. Rodriguez* (Universidad Autónoma de Madrid, Spain)
- PPD1-08 Impact of the magnetic field on the physical properties of magnetic ionic liquids, *C.I. Daniel, C.A.M. Afonso, F.V. Chávez, P.J. Sebastião, C.A.M. Portugal and J.G. Crespo* (Universidade Nova de Lisboa, Portugal)
- PPD1-09 Analysis of densities and surface tensions of binary mixtures of imidazolium-based ionic liquids: influence of cation and anion structure of the ionic liquid, *L.M. Casás, M.R. Currás, M. Mato, J.L. Legido and J. García* (Universidad de Vigo,

Spain)
PPD1-10 Isobaric heat capacity at high pressure and viscosity of a diphenyl ether + biphenyl mixture for solar thermal energy storage application, <i>L. Lugo, D. Cabaleiro, M.C. Martín, J.L. Legido and J.J. Segovia</i> (Universidad de Valladolid and Universidad de Vigo, Spain)
PPD1-11 Thermophysical characterization of ethylene glycol-based ZnO nanofluids, <i>M.J. Pastoriza-Gallego, D. Cabaleiro, L. Lugo, J.L. Legido and M.M. Piñeiro</i> (Universidad de Vigo, Spain)
PPD1-12 CO ₂ capture from high temperature sources using room temperature ionic liquids, <i>L.A. Neves, I.M. Coelho and J.G. Crespo</i> (Universidade Nova de Lisboa, Portugal)
PPD1-13 Ionic liquids based on bis(trifluoromethylsulfonyl)imide or alkylsulfate anions as neat lubricants in steel-steel contacts, <i>F.L. Sánchez, I. Otero, E.R. López and J. Fernández</i> (Universidad de Santiago de Compostela, Spain)
PPD1-14 Volumetric properties of a pyrrolidinium-based and two imidazolium-based ionic liquids at high pressures, <i>F.M. Gaciño, T. Regueira, M.J.P. Comuñas and J. Fernández</i> (Universidad de Santiago de Compostela, Spain)
PPD1-15 Long-term thermal stability of three ionic liquids, <i>J. Salgado, M. Villanueva, J. J. Parajó and J. Fernandez</i> (Universidad de Santiago de Compostela, Spain)
PPD1-16 ILs as extractors of carbohydrates from aqueous solutions, <i>A.A. Rosatella, L.C. Branco and C.A.M. Afonso</i> (Universidade de Lisboa and Universidade Nova de Lisboa, Portugal)
PPD1-17 Density of the reference ionic liquid [C6mim][NTf2] at high pressures, <i>J.C.F. Diogo, F.J.P. Caetano and J.M.N.A. Fareleira</i> (Universidade Técnica de Lisboa, Portugal)
PPD1-18 Novel ionic liquids based on L-cysteine derivatives, <i>K. Zalewska and L.C. Branco</i> (Universidade Nova de Lisboa, Portugal)
PPD1-19 Design of new hot-strip sensors to measure thermal conductivity of ionic liquid systems, <i>A.P.C. Ribeiro, M.J.V. Lourenço, F.J.V. Santos, J.M. Serra and C.A. Nieto de Castro</i> (University of Lisbon, Portugal)
PPD1-20 Complex molecular structures in binary mixtures of some [NR ₁ R ₂ R ₃ R ₄] ⁺ [Tf ₂ N] ⁻ ionic liquids in ethanol, <i>A.F.S. Santos, M.L.C.J. Moita, J.F.C.C. Silva and I.M.S. Lampreia</i> (University of Lisbon, Portugal)
20:00 Workshop Dinner Venue: Restaurant Churrasqueira do Campo Grande, Close to FCUL Campus

Day 2 (Friday, 3 February 2012)
8:30–9:00: Registration Venue: Building C1, Level 3, Northeast side Lobby
9:00–9:20: Session 5– Talk on NARILAR Project, <i>Alberto Coronas</i> (Coordinator) Venue: Building C1, LT 1.3.14
9:20-11:00: Session 6– Invited Lectures (Industry) Chair: Alberto Coronas (URV, Spain) and Carlos Nieto de Castro (FCUL, Portugal) Venue: Building C1, LT 1.3.14
6.1 Ionic liquids at BASF SE: introduction and technical applications, <i>Klemens Massonne</i> (Vice President, BASF SE, Ludwigshafen, Germany)
6.2 Industrial Progress: A new generation of commercially available working fluids for absorption chillers and heat pumps, <i>Matthias Seiler</i> (Director New Business Development, Evonik Industries AG, Hanau, Germany)
6.3 Brief overview about sorption media and thermal fluids, <i>Thomas J. S. Schubert</i> (CEO and Founder, Io-Li-Tec, Ionic Liquids Technologies GmbH, Germany)

6.4 Ionic liquids from Solchemar as functional organic materials, <i>Luis Branco</i> (Director Research and Development, Solchemar Lda., Portugal)
11:00–11:30: Coffee Break
11:30–13:30: Session 7–Oral Presentations (contributed papers) Topic: Ionic Liquid–Processes and Heat Transfer Chair: John Holbrey (QUILL, UK) and Manuel Matos Lopes (FCUL, Portugal) Venue: Building C1, LT 1.3.14
7.1 Ionic Liquids as gear lubricants and hydraulic fluids, <i>J. Fernández, J. Salgado, X. Paredes, T. Regueira, F.M. Gaciño and I. Otero</i> (Universidad de Santiago de Compostela, Spain)
7.2 Systematic study of the dynamic and static thermal stability of ionic liquids, <i>H.I.M. Veiga, J.M.S.S. Esperança, J.N.C. Lopes, L.P.N. Rebelo</i> (Universidade Nova de Lisboa, Portugal)
7.3 Recovery of ionic liquids from aqueous effluents using aluminium-based salts, <i>C.M.S.S. Neves, M.G. Freire and J.A.P. Coutinho</i> (University of Aveiro, Portugal)
7.4 Physical chemistry asks industry for a dance: what a reply???, <i>S.P. Verevkin, V.N. Emelyanenko and Dz.H. Zaitsau</i> (University of Rostock, Germany)
7.5 Rheology of ionic liquids, <i>F.J.V. Santos</i> (University of Lisbon, Portugal)
7.6 IoBiofluids: The new concept for thermal materials, <i>C.S. Queirós, S.I. Vieira, M.J.V. Lourenço, and C.A. Nieto de Castro</i> (University of Lisbon, Portugal)
13:30–15:00: Lunch and informal contacts (Venue: Building C6, Restaurant)
15:00–16:00: Session 8– Poster Presentations Venue: Building C6, Level 1, North side Lobby Best Poster Selection Committee: Luis Santos (FCUP, Portugal), Maria José Lourenço (FCUL, Portugal), and Maria Isabel Lampreia (FCUL, Portugal)
Poster#
PPD2-21 Ionic-liquid-based aqueous two-phase systems for the extraction of dyes, <i>A.M. Ferreira, M. G. Freire and J.A.P. Coutinho</i> (University of Aveiro, Portugal)
PPD2-22 Extraction of caffeine from guaraná seeds using aqueous ionic liquid solutions, <i>A.M. Ferreira, A.F.M. Cláudio, M.G. Freire and J.A.P. Coutinho</i> (University of Aveiro, Portugal)
PPD2-23 Thermophilic: An application for ionic liquids property estimation, <i>P.J. Carvalho, R.L. Gardas and J.A.P. Coutinho</i> (University of Aveiro, Portugal and IIT Madras, India)
PPD2-24 Ionic liquids for CO ₂ and CH ₄ separation, <i>P.J. Carvalho and J.A.P. Coutinho</i> (University of Aveiro, Portugal)
PPD2-25 Liquid-Liquid equilibria and transport studies of ternary systems composed of ionic liquid, 1-hexanethiol and n-dodecane, <i>A.R. Ferreira, M.G. Freire, L.A. Neves, J.C. Ribeiro, F.M. Lopes, J.G. Crespo and J.A.P. Coutinho</i> (University of Aveiro, Universidade Nova de Lisboa and Galp Energia, Portugal)
PPD2-26 Electrospinning of cellulose using non-volatile and non-flammable solvents: Ionic liquids, <i>A.R.R. Teles, M.G. Freire, R.A.S. Ferreira, L.D. Carlos, J.A.Lopes-da-Silva and J.A.P. Coutinho</i> (University of Aveiro, Portugal)
PPD2-27 Enthalpies of vaporization of ionic liquids, <i>V.N. Emelyanenko, Dz. H. Zaitsau, S.P. Verevkin and C. Schick</i> (University of Rostock, Germany)
PPD2-28 Performance of absorption heat transformers using ionic liquids and 2,2,2-trifluoroethanol (TFE) and methanol as working fluids, <i>D.S. Ayou, M. Curras, D. Salavera, J. García, J.C. Bruno and A. Coronas</i> (Universitat Rovira i Virgili and Universidad de Vigo, Spain)
PPD2-29 Preliminary measurements of the thermophysical properties of some ionic liquids with water for absorption chillers, <i>R. Nanda, V. Patil, D. Salavera, J.S. Urieta, A. Kumar and A. Coronas</i> (National Chemical Laboratory-India, Universitat Rovira i Virgili and Universidad de Zaragoza, Spain)
PPD2-30 Characterisation of some Ionic Liquids by various techniques, <i>V. Patil, R. Nanda, D.</i>

<p><i>Salavera, K.R. Patil, J. Urieta, A. Kumar and A. Coronas</i> (National Chemical Laboratory-India, Universitat Rovira i Virgili and Universidad de Zaragoza, Spain)</p> <p>PPD2-31 Interaction parameters from viscosity and polarity of the ionic liquid solutions: A model study, <i>S.K. Shukla and A. Kumar</i> (National Chemical Laboratory, India)</p> <p>PPD2-32 Liquid-liquid equilibria of ionic liquids for absorption refrigeration systems, <i>S. Thawarkar and A. Kumar</i> (National Chemical Laboratory, India)</p> <p>PPD2-33 Natural nano resources to enrich scientific and economical global needs, <i>C.S. Queirós, S.I. Vieira, M.J. Lourenço and C.A. Nieto de Castro</i> (University of Lisbon, Portugal)</p> <p>PPD2-34 Evidence of economic impact of quality measurements, <i>J.M.P França, C.A. Nieto de Castro, M.L.M. Lopes and S.M.S. Murshed</i> (University of Lisbon, Portugal)</p> <p>PPD2-35 State of the art research on exploitation of nanofluids as advanced heat transfer fluids, <i>S.M.S. Murshed and C.A. Nieto de Castro</i> (University of Lisbon, Portugal)</p> <p>PPD2-36 Current status and future prospects of ionanofluids, <i>S.M.S. Murshed, C.A. Nieto de Castro, M.J.V. Lourenço, F.J.V. Santos and M.L.M. Lopes</i> (University of Lisbon, Portugal)</p> <p>PPD2-37 Preliminary development of viscosity prediction of ionic liquid for absorption refrigeration systems, <i>A. Kumar, N. Khupse, T. Altamash, J.Mesones, D. Salavera and A. Coronas</i> (National Chemical Laboratory, India and Universitat Rovira i Virgili, Spain)</p> <p>PPD2-38 Thin films ILs as components of organic light emitting diodes, <i>J.C.S. Costa and L.M.N.B.F. Santos</i> (Universidade do Porto, Portugal)</p> <p>PPD2-39 Studies of organic solvent polarities using ionic liquids as additives, <i>R.T. Couto, C. Lourenço, J.C. Lima, P.C. Simões and L.C. Branco</i> (Universidade Nova de Lisboa, Portugal)</p> <p>PPD2-40 Functional task specific ionic liquids, <i>G.V.S.M. Carrera, S. Dias, A. Costa, A. Forte, M.N. Ponte and L.C. Branco</i> (Universidade Nova de Lisboa, Portugal)</p>	
<p>16:00–17:00: Session 9a- Panel discussion Venue: Building C1, LT 1.3.14 Chair: Alberto Coronas (URV, Spain) Rapporteur: Daniel Salavera (URV, Spain)</p> <p>Group 1–Absorption refrigeration and heat pumps <i>(Please leave your name at registration desk)</i></p>	<p>16:00–17:00: Session 9b- Panel discussion Venue: Building C1, LT 1.3.15 Chair: Carlos Nieto de Castro (FCUL, Portugal) Rapporteur: Sohel Murshed (FCUL, Portugal)</p> <p>Group 2– New heat transfer and engineering fluids <i>(Please leave your name at registration desk)</i></p>
<p>17:00–18:00: Session 10 – Reports from working groups and discussion (+Coffee) Venue: Building C1, LT 1.3.14 Chair: Alberto Coronas (URV, Spain) and Carlos Nieto de Castro (FCUL, Portugal) Group 1–Absorption refrigeration and heat pumps Group 2– New heat transfer and engineering fluids</p>	
<p>18:00–18:30: Closing Remarks and Way Forward Venue: Building C1, LT 1.3.14</p>	

Annex 2 – Logos of sponsors



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Annex 3 – Website

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On the occasion of the Commemoration of the Centenary of Faculdade de Ciências da Universidade de Lisboa (FCUL) and on the advent of several major modifications in energy utilization and recovery, the Department of Chemistry and Biochemistry of FCUL, in collaboration with the Universitat Rovira i Virgili, Tarragona, Spain, have decided to jointly promote a workshop on the potential applications of Ionic Liquids (ILs) and their mixtures with other solvents and nanomaterials in two very important areas:

- Absorption refrigeration and heat pumps
- New heat transfer fluids

It is the aim of the workshop to bring together researchers working on ILs, heat transfer fluids, and nanomaterials as well as company people producing and supplying ILs and to discuss on possible working fluids particularly ILs for heat transfer applications, their economical viability and technical challenges. Related industries will be invited to participate in the workshop for potential discussions and collaborations. The workshop will feature motivation and plenary talks from internationally recognized academic and industrial experts in the field followed by presentations of contributed papers and posters.

Workshop topics include:

- ILs as heat transfer fluids
- Application of ILs in absorption refrigeration and heat pumps
- Commercialized applications of ILs
- New and Ionano-fluids as advanced coolants

This workshop is part of the **NARILAR** - New Working Fluids based on Natural Refrigerants and Ionic Liquids for Absorption Refrigeration and was recognized as **EUROTHERM Seminar 97**.

Workshop Poster

Please disseminate this announcement to your colleagues who might also be interested in attending this workshop.

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The President of EUROTHERM in 2010-2014 is Prof. Anton A. van Steenhoven, Eindhoven University of Technology, the Netherlands (E-mail: a.a.v.steenhoven@tue.nl) Information on future SEMINARS is available from the Secretary, Prof. Darrin Murray, Professor Darrin B. Murray, School of Engineering, Trinity College, Dublin, Ireland (E-mail: dmurray@tcd.ie).

Information on the EUROTHERM Committee and its activities is available in Internet at: <http://www.eurothermcommittee.eu>

Last updated 2012-02-01

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Annex 4 – Leaflet

<p>Supports</p> <p>This workshop is an event of the NARILAR European Project- New Working Fluids based on Natural Refrigerants and Ionic Liquids for Absorption Refrigeration.</p> <p>Please disseminate this announcement to your colleagues who might also be interested in attending this workshop.</p> <p>All Rights Reserved-WILS2012</p>	<p>Venue</p> <p>Faculty of Sciences of the University of Lisbon (FCUL Campus) Campo Grande, 1749-016 Lisbon, Portugal (FCUL Campus is only 4 km from Lisbon International Airport)</p> <p>Organized by</p> <p>Department of Chemistry and Biochemistry Faculty of Sciences of the University of Lisbon and Universitat Rovira I Virgili , Tarragona, Spain</p> <p>Organizing Committee</p> <p>Carlos Nieto de Castro Department of Chemistry and Biochemistry, FCUL, Portugal</p> <p>Alberto Coronas CREVER, Universitat Rovira I Virgili, Spain</p> <p>S. M Sohel Murshed Centre for Molecular Sciences and Materials, FCUL, Portugal</p> <p>Daniel Salavera CREVER, Universitat Rovira I Virgili, Spain</p> <p>Luís Paulo Rebelo ITQB, Universidade Nova de Lisboa, Portugal</p> <p>Maria J. V. Lourenço Department of Chemistry and Biochemistry, FCUL, Portugal</p> <p>Joan Carles Bruno CREVER, Universitat Rovira I Virgili, Spain</p> <p>Fernando J. V. Santos Department of Chemistry and Biochemistry, FCUL, Portugal</p>	<p>WILS2012 Announcement of Workshop and Call for Papers</p> <p>International Workshop on Ionic Liquids–Seeds for New Engineering Applications</p> <p>2-3 February 2012</p> <p>Lisbon, Portugal</p> <p>www.dqb.fc.ul.pt/wils2012</p>
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WILS2012

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About the Workshop

On the occasion of the Commemoration of the Centenary of Faculdade de Ciências da Universidade de Lisboa (FCUL) and on the advent of several major modifications in energy utilization and recovery, the Department of Chemistry and Biochemistry of FCUL in collaboration with the Universitat Rovira I Virgili (URV), Tarragona, Spain, have decided to jointly promote this workshop on the potential applications of Ionic Liquids (ILs) and their mixtures with other solvents and nanomaterials in two very important areas:

- ◊ Absorption refrigeration and heat pumps
- ◊ New heat transfer fluids

Scope

It is the aim of the workshop to bring together researchers working on ILs, heat transfer fluids, and nanomaterials as well as company people producing and supplying ILs and to discuss on possible working fluids particularly ILs for heat transfer applications, their economical viability and technical challenges. Related industries will be invited to participate in the workshop for potential discussions and collaborations. The workshop will feature motivation and plenary talks from internationally recognized academic and industrial experts in the field followed by presentations of contributed papers and posters.

Workshop Topics

- ◊ Ionic liquids as heat transfer fluids
- ◊ Application of ionic liquids in absorption refrigeration and heat pumps
- ◊ Commercialized applications of ionic liquids
- ◊ Nano and Ionano-fluids as advanced coolants

Important Dates

Submission of extended abstract: **31 October 2011**
 Notification of abstract acceptance: **30 November 2011**
 Final extended abstract submission and early registration: **30 December 2011**
 On-site registration and workshop: **2-3 February 2012**

Registration Fees

Early registration (by 30 December 2011):
Delegate: 350€
Student: 175€
 Late registration (after 30 December 2011):
Delegate: 400€
Student: 200€

Registration fees include workshop proceedings, workshop goodies, refreshments during breaks in workshop sessions, lunches and the workshop dinner.

Registration Details

Registration fee payment methods will soon be posted on the workshop website.

Abstract Submission

Authors are invited to email 1-2 page extended abstract (PDF and MS Word versions) to wils2012@fc.ul.pt. The abstract should include each author's information (name, affiliation, full address, telephone and email address), brief introduction followed by key results (graphs, figures or result tables) and a succinct discussion of the findings.

Publications

Besides conference proceedings, a number of high quality papers will be selected for publication after peer review process in a special issue of Journal of Chemical and Engineering Data (ACS).

Secretariat and Contact

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 Faculty of Sciences of the University of Lisbon
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 E-mail: wils2012@fc.ul.pt
www.dqb.fc.ul.pt/wils2012

Annex 5 – Announcing Poster



International Workshop on Ionic Liquids– Seeds for New Engineering Applications 2-3 February 2012, Lisbon, Portugal

The Department of Chemistry and Biochemistry of FCUL in collaboration with the Universitat Rovira i Virgili (URIV), Tarragona, Spain, promote a workshop on the potential applications of Ionic Liquids and their mixtures with other solvents and nanomaterials. It will feature motivation and plenary talks from internationally recognized academic and industrial experts in the field.



Workshop topics

Ionic liquids as heat transfer fluids, commercial applications of Ionic liquids, Nano and Ionanofluids as advanced coolants, as absorption refrigeration and heat pump systems and much more.

Venue

Faculdade de Ciências da Universidade de Lisboa, Campo Grande, 1749-016 Lisbon, Portugal

Organizing Committee

Carlos Nieto de Castro (DQB-FCUL, Portugal), *Alberto Coronas* (CREVER, URIV, Spain), *S M Sohel Murshed* (CCMM-FCUL, Portugal), *Daniel Salavera* (CREVER, URIV, Spain), *Luís Paulo Rebelo* (ITQB, UNL, Portugal), *Maria J. V. Lourenço* (DQB-FCUL, Portugal), *Joan Carles Bruno* (CREVER, URIV, Spain), *Fernando J. V. Santos* (DQB-FCUL, Portugal)

Information www.dqb.fc.ul.pt/wils2012

This workshop is an event of the NARILAR European Project-New Working Fluids based on Natural Refrigerants and Ionic Liquids for Absorption Refrigeration

Supports

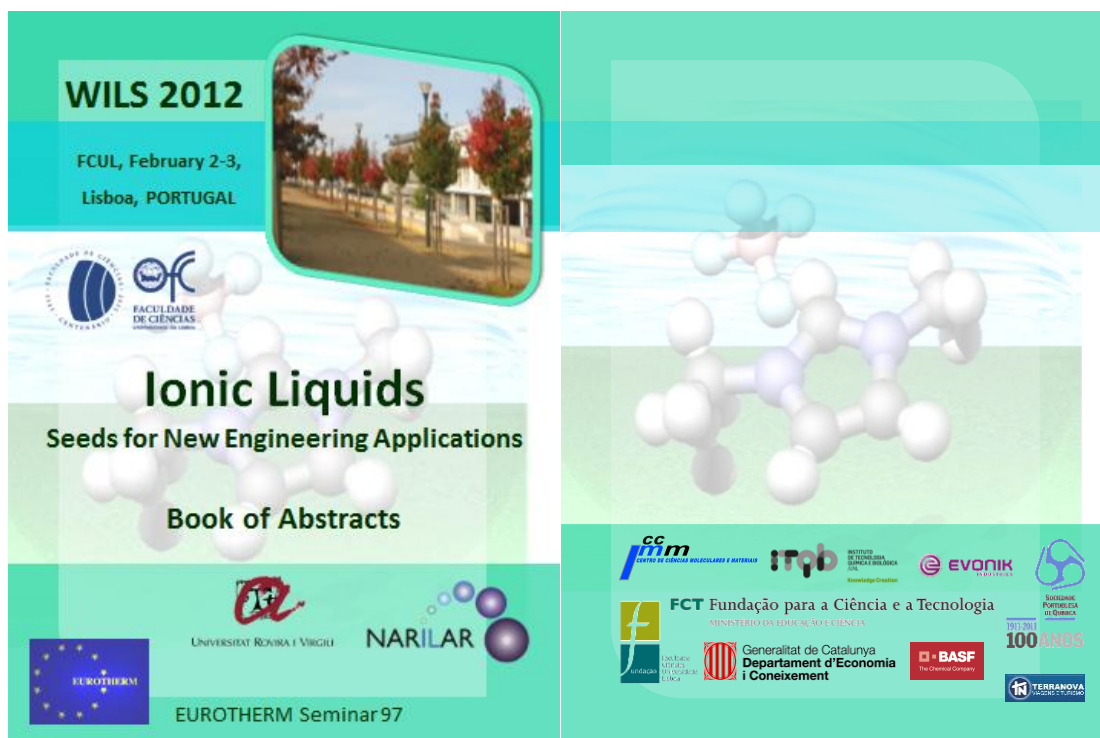


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Annex 6 – Book of abstracts



Annex 7 – Photo of participants



Photo by Tiago Duarte, 2012