

GREEN INDUSTRIAL APPLICATIONS OF IONIC LIQUIDS.

April 12-16, 2000, Heraklion, Crete, Greece.

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Scientific Content of ARW.

Forty-one scientists and engineers from academia, industry, and government research laboratories met in Heraklion on the island of Crete to discuss the current and future status of the application of ionic liquids to new green industrial technologies. They were joined by six industry observers and four student/staff helpers.

The workshop began with a plenary lecture on green chemistry followed by three-and-a-half days of intensive lectures and discussion on the current status of ionic liquid research and application. Topics covered included industrial needs in green chemistry, current industrial applications of ionic liquids, separations, electrochemistry, novel chemistries in ionic liquids, green catalysis, and the status of East-West collaborations.

The last day-and-a-half were devoted to roundtable discussions meant to distill the workshops content into major recommendations of the ionic liquid research community. The three roundtables included a) outlining industrial priorities, needs, and challenges in green chemistry, b) drafting ionic liquids research priorities to meet the green needs of the chemical industry, and c) developing protocols to enhance East-West collaborations in ionic liquids research.

The major outcomes of the workshop included the following:

- Ionic liquids are intrinsically interesting and worthy of study for advancing science (ionic vs. molecular solvents) with the expectation that something useful may be derived from their study.
- Combined with green chemistry, a new paradigm in thinking about synthesis in general, ionic liquids provide an opportunity for science/engineering/business to work together from the beginning of the field's development.
- Readily available, well characterized ionic liquids, free of intellectual property, are needed to encourage development of applications.
- Toxicity, biodegradation, bio-accumulation, safety, health, and environment (SHE) impact data are needed immediately.
- Ionic liquid research should include cost/benefit, economic, and life-cycle analyses.
- Regulatory road blocks to ionic liquid implementation should be tackled now.
- A public (free), verified, web-based database of physical, thermodynamic, and related data (i.e., not process specific) is needed, and work should start immediately on identifying the best methods to accomplish this.
- There is an urgent need to increase the number, but especially the areas of expertise of ionic liquids researchers. A model of open collaboration needs to be encouraged.
- International collaboration and communication/education regarding the results are needed.
- A brochure should be developed to advance the understanding of ionic liquids and their applications.
- A NATO Advanced Study Institute should be held dedicated to all facets of the study and application of ionic liquids from scientific, engineering, and business perspectives. This meeting should occur no earlier than Spring 2002.

Main Lectures/papers given

Green Chemistry, Theory and Practice, J. Warner, Univ. Massachusetts, Boston, USA.
Potential for Use of Ionic Liquids in Czech Industry, J. Kotlán, VÚOS a.s, Czech Republic.
Potential to Apply Ionic Liquids in Industry, P. Wasserscheid, RTWH Aachen, Germany.
Ionic Liquids and the Petrochemical Industry, B. Ellis, BP Amoco, UK.
Application of Ionic Liquids to Biphasic Catalysis, H. Olivier, IFP, France.
High Temperature NMR studies of Ionic Liquids Catalysts, O. Lapina, Boreskov Institute of Catalysis, Russia.
Ionic Liquids as Alternatives to Traditional Organic and Inorganic Solvents, R. Pagni, Univ. Tennessee-Knoxville, USA.
Ionic Liquids and the Pharmaceutical Industry, R. Freer, SmithKline Beecham, UK.
Ionic Liquids as Solvent Replacements in Industrial-Scale Separations – Opportunities and Challenges, R. D. Rogers, The Univ. of Alabama, USA.
Applications of Ionic Liquids to the Chemical Processing of Biomass-Derived Renewable Feedstocks, L. Moens, National Renewable Energy Laboratory, USA.
Room Temperature Sulfur Chloride Ionic Liquids in Processes for Isolation of Noble and Other Metals, V. Pekhnyo, Inst. Gen. Inorg. Chem., Ukraine.
Using Ionic Liquids for Oil Shale Extraction, M. Koel, Tallinn Tech. Univ., Estonia.
Ionic Liquids as Catalysts for Sulfuric Acid Production and Cleaning of Flue Gases, R. Fehrmann, Institut for Kemi, Denmark.
Modelling the Liquid Behavior of Ionic Liquids, E. Gontcharenko, Kabardino-Balkarian College, Russia.
The Challenges of Building a Molten Salt Database, M. Gaune-Escard, IUSTI, France.
The Past, Present, and Future of Ionic Liquids as Battery Electrolytes, J. Wilkes, U.S. Air Force Academy, USA.
Properties of Highly Conductive Imidazolium Ionic Liquids, and Applications to Nanocrystalline Photovoltaic and Electrochromic Devices, P. Bonhôte, LPI, Switzerland.
Photochemistry in Ionic Liquids, C. Gordon, Univ. of Strathclyde, UK.
Ionic Liquids Derived from Natural Products and Other Novel Chemistries, J. Davis, Univ. South Alabama, USA.
Ionic Liquids and Supercritical CO₂, J. Brennecke, Univ. Notre Dame, USA.
Ionic Liquids Crystals as Universal Matrices (Solvents) for Novel Materials for Opto- and Microelectronics, T. Mirnaya, Inst. Gen. Inorg. Chem., Ukraine.
Organic Chemistry in Ionic Liquids, T. Welton, Imperial College, UK.
Industry Perspective of Green Catalysis, C. Adams, Inst. Appl. Catalysis, UK.
Ionic Liquids and Specialty Chemicals, D. Moody, Avecia, UK.
East-West Collaboration within the Sfp Programme: Opportunities and Project Management, S. Boghosian, FORTH/ICE-HT, Greece.

Organizing Committee

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