



## Abstract Listing

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### **419049: Ionic liquids as novel diluents for solvent extraction of metal salts by crown ethers**

#### **IEC 0 [419049]: Ionic liquids as novel diluents for solvent extraction of metal salts by crown ethers**

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#### **ACCEPTED**

**Topic Selection:** *Green (or Greener) Industrial Applications of Neoteric Solvents: Ionic and Supercritical Fluids: Separations and Engineering*

**Invited:** *Y*

**Preferred Presentation Format:** *OralOnly*

**Consider for Sci-Mix:** *N*

**Conforms to Bylaw 6:** *Y*

**Last Modified:** *2000-11-19*

#### **Abstract**

Results are reported for solvent extractions of metal salts from aqueous media into crown ether solutions in 1-alkyl-3-methylimidazolium hexafluorophosphates. For these room-temperature ionic liquids (RTILs), the 1-alkyl group was varied from butyl through nonyl. For competitive alkali metal chloride extractions by dicyclohexano-18-crown-6 (DC18C6), the extraction efficiency decreased as the 1-alkyl group was elongated. (Under these conditions, only barely detectable metal chloride extraction was observed with DC18C6 solutions in benzene, chloroform, 1-octanol and nitrobenzene.) The extraction selectivity order was potassium > rubidium > cesium > sodium > lithium. Although the K/Li, K/Rb and K/Cs selectivities remained constant as the 1-alkyl group of the RTIL was varied, the K/Na selectivity exhibited significant variation in the order octyl > heptyl, nonyl > butyl, pentyl, hexyl. For competitive alkali metal salt extractions, the efficiency and selectivity were unaffected with the aqueous phase anion was varied from chloride to nitrate to sulfate. Results are also reported for non-competitive extractions of lead salts with DC18C6 in these RTILs.

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### **419426: Supported ionic liquid membrane reactors: Energy savings with reduced materials requirements**

#### **IEC 0 [419426]: Supported ionic liquid membrane reactors: Energy savings with reduced materials requirements**

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**ACCEPTED**

**Topic Selection:** *Green (or Greener) Industrial Applications of Neoteric Solvents: Ionic and Supercritical Fluids: Separations and Engineering*

**Invited:** *Y*

**Preferred Presentation Format:** *OralOnly*

**Consider for Sci-Mix:** *N*

**Conforms to Bylaw 6:** *Y*

**Last Modified:** *2000-11-19*

**Abstract**

In supported liquid membranes (SLMs), a liquid is introduced into a porous membrane so that the liquid seals the pores of the supporting polymer matrix and acts as a permeable medium for a separation process. In the early 1980's, ionic liquids were used to develop supported ionic liquid membranes (SILMs) capable of highly selective gas membranes. More recently, we have extended the SILM concept to create catalytic reactor membranes comprised of either chloroaluminate or catalyst-containing, water-stable ionic liquids for continuous oligomerization and hydrogenation reactions. Compared to bulk reactor approaches, SILMs offer numerous advantages: (1) direct separation of reactants and products without additional energy input; (2) simple kinetic control over reaction product distribution; (3) minimal volumetric ionic liquid requirements; (4) straightforward series reactor designs; (5) simplified reactor scaling from bench to production; (6) reduced corrosion and contamination; and (7) simple cartridge replacement of spent catalyst. And like bulk approaches, the ionic liquid is easily recovered for recycling and for catalyst recovery or reactivation.

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**420211: Characterization of solute solvent properties in ionic liquids by gas chromatography****IEC 0 [420211]: Characterization of solute solvent properties in ionic liquids by gas chromatography**

**W. Matthew Reichert**<sup>1</sup>, Ann E. Visser<sup>1</sup>, Richard P. Swatloski<sup>1</sup>, Robin D. Rogers<sup>1</sup>, and Mihkel Koel<sup>2</sup>. (1) Department of Chemistry and Center for Green Manufacturing, The University of Alabama, Tuscaloosa, AL 35487, Fax: 205-348-9104, chewy@mrlimpit.ch.ua.edu, (2) Institute of Chemistry, Tallinn Technical University

**ACCEPTED**

**Topic Selection:** *Green (or Greener) Industrial Applications of Neoteric Solvents: Ionic and Supercritical Fluids: Separations and Engineering*

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**Preferred Presentation Format:** *Oral*

**Consider for Sci-Mix:** *N*

**Conforms to Bylaw 6:** *Y*

**Last Modified:** *2000-11-19*

**Abstract**

Ionic liquids are advertised as new environmentally friendly solvents, but their physical properties are

not yet well understood. Gas-liquid chromatography is an attractive way to evaluate interactions between ionic liquids and organic molecules as well as differences between various ionic liquids. 1-Alkyl-3-methylimidazolium based ionic liquids provide column packing of similar efficiency to non-ionic phases. A number of thermodynamic constants were measured for McReynolds selectivity probes. These constants indicate that the ionic liquid stationary phases show a dual nature. They appear to act as a low-polarity stationary phase for non-polar compounds, but polar molecules, which are capable of spatial and proton donor or acceptor interactions, are strongly retained. The nature of the anion has a significant effect on both the solubilizing ability and the selectivity of the ionic liquid stationary phases.

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### **423823: Super acidic ionic liquids for carbonylation of aromatic compounds**

#### **IEC 0 [423823]: Paper deleted**

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### **435068: Supported ionic liquid membranes and facilitated ionic liquid membranes (FILM's)**

#### **IEC 0 [435068]: Supported ionic liquid membranes and facilitated ionic liquid membranes (FILM's)**

**Paul Scovazzo**<sup>1</sup>, Ann E. Visser<sup>2</sup>, James H. Davis Jr.<sup>3</sup>, Robin D. Rogers<sup>2</sup>, Richard D. Noble<sup>1</sup>, and Carl Koval<sup>4</sup>. (1) Department of Chemical Engineering, University of Colorado, Campus Box 424, Boulder, CO 80309, scovazzo@colorado.edu, (2) Department of Chemistry and Center for Green Manufacturing, The University of Alabama, (3) Department of Chemistry, University of South Alabama, (4) Department of Chemistry and Biochemistry, University of Colorado

#### **ACCEPTED**

**Topic Selection:** *Green (or Greener) Industrial Applications of Neoteric Solvents: Ionic and Supercritical Fluids: Separations and Engineering*

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**Preferred Presentation Format:** *Oral*

**Consider for Sci-Mix:** *N*

**Conforms to Bylaw 6:** *Y*

**Last Modified:** *2000-11-19*

#### **Abstract**

Supported Liquid Membranes (SLM's) use porous supports whose pores are impregnated with a solvent. In SLM's, solute molecules dissolve into the membrane at the feed/membrane interface. The dissolved species diffuse through the membrane and desorb at the opposite membrane surface. The addition of a third mobile chemical or carrier to the solvent that can reversibly bind to the dissolved species enhances the selectivity of the membrane (facilitated transport). The disadvantages of SLM's are the loss of solvent via volatilization and the loading limits (solubility) on complexing agents in the solvent that limits the obtainable flux rate. Unlike the solvents currently used in SLM's, Room Temperature Ionic Liquid (RTIL) properties may be adjusted via chemical alteration of the ions to produce "designer solvents" for a specific membrane application. The potential exists for complexing

agents to be one of the ions giving a mole fraction loading of a complexing agent in the solvent of one, much greater than the loadings in standard systems. Supported Ionic Liquid Membranes (SILM) also have an advantage over SLM's due to the RTIL's negligible loss through vaporization. Our initial research focus is on the CO<sub>2</sub> separation from N<sub>2</sub> using RTIL's with and without ionic and non-ionic doping compounds. We have proven the concept of SILM's. In addition we are determining the basic principles for developing working Facilitated Ionic Liquid Membranes (FILM's). Our paper presents the proof-of-concept of SILM's, the basic principles of FILM development, and discusses future needs for continued development of SILM's and FILM's.

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**435394: aaaaa**

**IEC 0 [435394]: aaaaa**

**REJECTED**

*Topic Selection: Green (or Greener) Industrial Applications of Neoteric Solvents: Ionic and Supercritical Fluids: Separations and Engineering*

*Invited: Y*

*Preferred Presentation Format: Oral*

*Consider for Sci-Mix: N*

*Conforms to Bylaw 6: Y*

*Last Modified: 2000-11-19*

**Abstract:** Abstract text not available.

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**440965: Electrochemical Behavior of Actinide Compounds Electrochemically Generated in Ionic Liquid Media**

**IEC 0 [440965]: Electrochemical Behavior of Actinide Compounds Electrochemically Generated in Ionic Liquid Media**

**W.R. Pitner**<sup>1</sup>, **D. Sanders**<sup>2</sup>, **A.E. Bradley**<sup>2</sup>, **K.R. Seddon**<sup>3</sup>, **R. C. Thied**<sup>4</sup>, **J.E. Kingston**<sup>4</sup>, and **H.E. Simms**<sup>5</sup>. (1) School of Chemistry, Queen's University Belfast, Belfast BT9 5AG, United Kingdom, w.pitner@qub.ac.uk, (2) School of Chemistry, Queen's University Belfast, (3) QUILL, Queen's University Belfast, (4) Research and Technology, British Nuclear Fuels (BNFL), (5) Nuclear Science, AEA Technology plc

**ACCEPTED**

*Topic Selection: Green (or Greener) Industrial Applications of Neoteric Solvents: Ionic and Supercritical Fluids: Separations and Engineering*

*Invited: Y*

*Preferred Presentation Format: Oral*

*Consider for Sci-Mix: Y*

*Special Equipment Needs: power point presentation would be preferred*

*Conforms to Bylaw 6: Y*

*Last Modified: 2000-11-19*

**Abstract**

Electrolysis of uranium and plutonium metals has been carried out in ionic liquids based on the 1,2-dialkylimidazolium cation. In the case of uranium, a comparison of the charge passed during electrolysis and the weight lost by the uranium electrode indicates that the species generated is U(III). However, an examination of the solution using EXAFS indicated the species in solution is U(IV), suggesting that the generated species undergoes chemical oxidation following electrolysis. Cyclic voltammetry was used to investigate the electrochemical behavior of the uranium species in solution. In the case of plutonium, the metal reacts spontaneously with the ionic liquid, so it is not possible to accurately determine which species is generated through electrolysis using a charge to mass balance. However, by analogy to the uranium system, it was assumed that Pu(III) was generated. Cyclic voltammetry indicated that the electrochemically generated plutonium species does not undergo spontaneous oxidation to Pu(IV).

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**441766: Liquid-liquid equilibria in ionic liquid-organic solvent systems****IEC 0 [441766]: Liquid-liquid equilibria in ionic liquid-organic solvent systems**

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**ACCEPTED**

**Topic Selection:** *Green (or Greener) Industrial Applications of Neoteric Solvents: Ionic and Supercritical Fluids: Separations and Engineering*

**Invited:** *N*

**Preferred Presentation Format:** *OralOnly*

**Consider for Sci-Mix:** *N*

**Special Equipment Needs:** *overhead projector*

**Conforms to Bylaw 6:** *Y*

**Last Modified:** *2000-11-19*

**Abstract**

Ionic liquids are excellent solvents for a broad range of polar and non-polar organic compounds. A series of water and air stable ionic liquids result from salts composed of the 1-alkyl-3-alkylimidazolium cation and hexafluorophosphate anion. It is believed that the solvent properties of these ionic liquids can be tailored to meet the requirements of specific applications by a judicious variation in the length and branching of the alkane chains and the anionic precursor thus creating an almost infinitely set of "designer solvents". While there have been a number of studies on the kinetics of organic reactions in these solvents there have been few studies on either the thermophysical properties of ionic liquids themselves or their mixtures with organic solvents. Ionic liquids exhibit some unusual mixture properties. For example, 1-alkyl-3-alkylimidazolium hexafluorophosphates are insoluble in water, soluble in polar solvents, and partly soluble in aromatic solvents and aliphatic solvents. Liquid-liquid equilibria of various organic solvents with 1-alkyl-3-alkylimidazolium hexafluorophosphate over a temperature range will be presented and the possibilities of using these ionic liquids as tailored "designer solvents" will be discussed.

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**444044: Intermission****0 [444044]: Intermission****ACCEPTED**

**Topic Selection:** *Green (or Greener) Industrial Applications of Neoteric Solvents: Ionic and Supercritical Fluids: Separations and Engineering* **Preferred Presentation Format:** *Break*

**Consider for Sci-Mix:**

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**444045: Discussion****0 [444045]: Discussion****ACCEPTED**

**Topic Selection:** *Green (or Greener) Industrial Applications of Neoteric Solvents: Ionic and Supercritical Fluids: Separations and Engineering* **Preferred Presentation Format:** *Break*

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