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EMERGING RESEARCH FRONTS - 2008

December 2008

PDF

Daniel W. Armstrong talks with *ScienceWatch.com* and answers a few questions about this month's Emerging Research Front Paper in the field of Engineering. The author has also sent along images of their work.

Article: Structure and properties of high stability geminal dicationic ionic liquids
Authors: Anderson, JL;Ding, RF;Ellern, A;Armstrong, DW
Journal: J AM CHEM SOC, 127 (2): 593-604 JAN 19 2005
Addresses: Iowa State Univ, Dept Chem, Ames, IA 50011 USA.
Iowa State Univ, Dept Chem, Ames, IA 50011 USA.

SW: Why do you think your paper is highly cited?

Research involving ionic liquids (ILs) is of broad scientific interest (see attached table). Unfortunately their touted beneficial properties of high thermal stability, low volatility, physico-chemical tunability, etc., were not as profound as had been initially thought. Also it was difficult to characterize and differentiate these unique liquid salts.

In this one paper, we first introduced multifunctional ILs and demonstrated their greatly enhanced stability and tunablity (see attached figure to the right). Furthermore we outlined the most definitive approach for characterizing them via their solvent properties, as well as outlining the factors that contributed to their low-temperature crystallization.

SW: Does it describe a new discovery, methodology, or synthesis of knowledge?

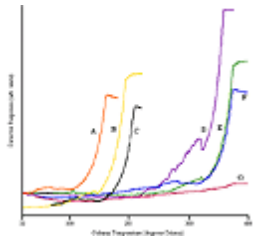
We described the first synthetic protocols for this new class of ultra-high stability ILs as well as the best way to characterize them. Also the structural factors that controlled crystallization and melting points were considered. Finally, important applications for these new materials were outlined.

SW: Would you summarize the significance of your paper in layman's terms?

We have developed a new class of ultra-high stability liquids that will impact many areas of science and technology. Many things that previously were considered to be difficult or even impossible to accomplish may now be feasible with these new materials.

SW: How did you become involved in this research, and were there any particular problems encountered along the way?

I became involved in this area of research a few years ago as a result of personal curiosity. I wondered if conventional ILs could be used as unique separation media as well as to enhance mass spectrometry. Either they could not or they were severely limited. Rather than leave the field, we devised ways to produce enhanced ILs that could accomplish truly difficult tasks. To do this we had to increase our synthetic capabilities and achieve a better general understanding of the nature of ILs.



Download the uses of RTILs (includes figure and description).

PDF

SW: Where do you see your research leading in the future?

We will continue to develop novel ILs and to enhance our understanding of the factors that control their properties. We will focus on chiral ILs and unique ILs that can be used to solve specific scientific and technological problems. Also we have found that some of our new ILs have interesting medicinal/pharmacological properties. These will be pursued.

SW: Do you foresee any social or political implications for your research?

It is difficult to predict future social or political implications. However, it is clear that our ILs are now (and will continue to be) introduced as new scientific and consumer products. Further, if the future pharmacological properties can be validated, these unique compounds may enhance not only employment but also health and well-being. Also, since ILs are considered "green solvents" in terms of air pollution, there are possible environmental benefits.

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Keywords: ionic liquids, high thermal stability, low volatility, physico-chemical tunability, liquid salts.

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