

Ionic Liquids

Green Solvents for Organic Replacement

...goodbye VOC's

The Problem with Solvents

Knowledge in chemistry is a two-way street. The more we know, the more we can do, but we are also learning more about health and environmental hazards. Many of the solvents of yesterday's industry are now recognized and regulated as harmful. It may seem like the properties you cherished for organic synthesis will have to give way to protecting our environment and our selves. The fast lane for progress, though, is to make use of that knowledge to improve the road, and maybe even yield better processing, rather than letting others pass you by.

Examples of Ionic Liquids based on 2-ethylhexanoates:

Cobalt (II)
Nickel (II) (RTIL)
Zinc (II) (RTIL)
Choline (RTIL)
Ethylenediamine (RTIL)

Patent pending

The Ionic Liquid Benefit

Ionic liquids are a route to volatile organic solvent replacement. *nGimat* has synthesized a new series of ionic liquids, including some as room temperature ionic liquids. The new ionic liquids are unique in that they are halogen free. These compounds have low vapor pressure and a range of properties that can allow use for solvents, electrolytes, heat storage, metal processing, performance additives, and separation processes.

Ionic Liquid: Salt with a melting point below 100 °C.

Room-temperature Ionic Liquid (RTIL): Salt with a melting point below 25 °C.

nGimat's Ionic Liquids

Features	Advantages
<ul style="list-style-type: none">• Low vapor pressure• Unusual solvent properties• Biphasic systems formation possible• Liquid range up to -50 to 250 °C	<ul style="list-style-type: none">• Essentially zero VOC emissions; non-flammability• New synthetic pathways; reaction rate increase• Liquid-liquid extraction

Not Just Green

Ionic liquids not only provide a less hazardous solvent option, they also have useful industrial applications:

Dissolution of metal oxides → ore, refractory, and metal oxide processing

Immiscibility with water → separations

Dissolve polar and non-polar hydrocarbons → flexibility in organic synthesis

***nGimat*™ Co.**

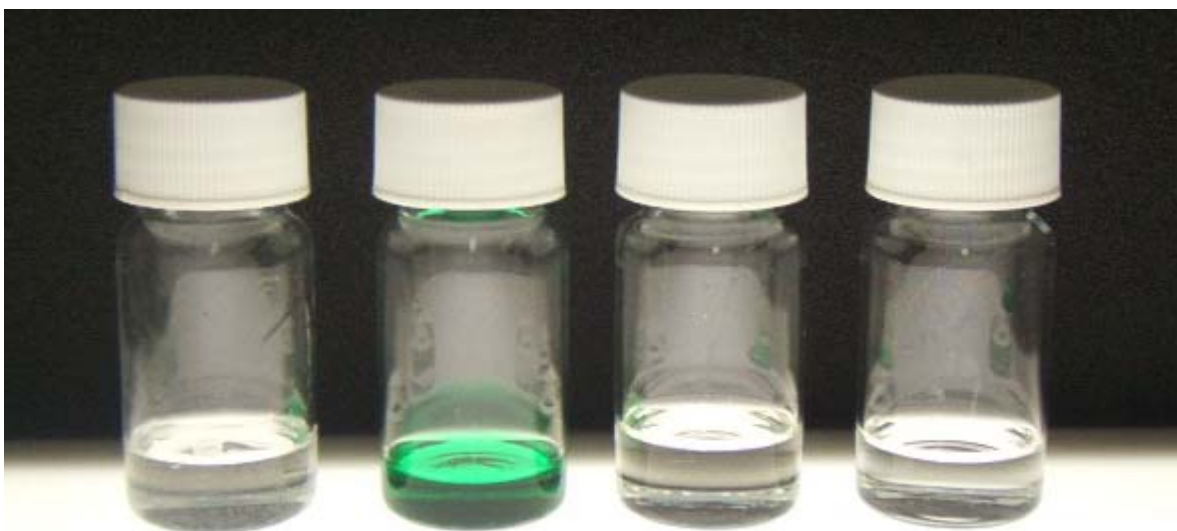
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Ionic Liquids

Green Solvents for Organic Replacement

*n*Gimat's ionic liquids were developed at the company as a spin-off of our NSF-funded work to develop methods to optimize environmentally-friendly solvent mixtures. These and another *n*Gimat tool, Green Solvent Wizard™ solvent replacement software, originated to meet R&D and industrial needs to avoid depending on the rapidly lengthening list of solvents falling under tighter and more restrictive regulations. Solubility of organic precursors is a fundamental requirement in our company's NanoSpraySM and Combustion Chemical Vapor Deposition processes for producing nanopowders and thin films. To this end, selection of useful and yet benign solvents became challenging, so our chemists set to work to find an alternative. The pictures below illustrate some of our ionic liquids to date.



Room temperature ionic liquids, from Left to Right: Zinc (II) 2-ethylhexanoate (colorless), Nickel (II) 2-ethylhexanoate (green), Ethylenediamine bis(2-ethylhexanoate) (colorless), Choline 2-ethylhexanoate (colorless), all liquids at 20 °C.

Customer Solutions. *n*Gimat is interested in working with you on ionic liquid solutions for your processes. We offer development and sale of materials, research and development services for special technologies, or licensing under strategic alliances and joint ventures. Contact us for more information.

The Company. *n*Gimat, located inside the perimeter of Atlanta, is an intellectual property and manufacturing company that engineers nanopowders, thin films, and devices. Our facilities are equipped with instrumentation to perform cutting edge materials research, development, and manufacturing. The scientists and engineers at *n*Gimat bring backgrounds in materials science, chemistry, physics, mechanical/chemical/electrical engineering, and biochemistry to the challenges of engineering nanomaterials. In addition, our analytical personnel provide rapid turn-around times and state-of-the-art materials analysis to support our materials development.

We at *n*Gimat Co. would like to discuss how ionic liquids can fit into your formulation needs.

Please visit us at www.ngimat.com or contact us:

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