INL/MIS-19-54167-Revision-1

Task-Specific Ionic Compounds for In-Field Sample Preparation Poster

May 2019

Christopher A Zarzana, Gary S Groenewold, Kumari K Sharma, Rika Hagiwara

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Idaho National Laboratory

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Task-Specific Ionic Compounds for In-Field Sample Preparation

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Impact

Reduce time for debris analysis after a nuclear incident and increase confidence in results for decision makers.

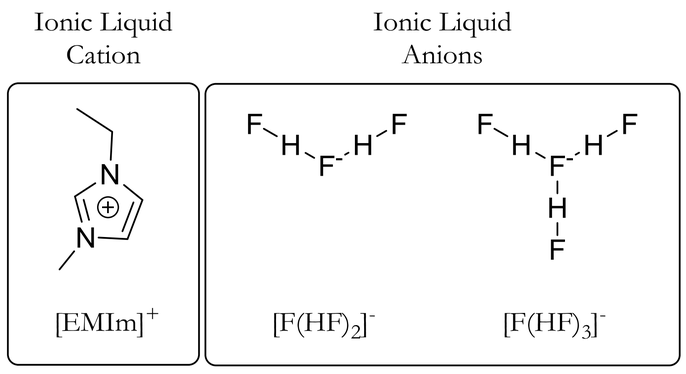
Objective

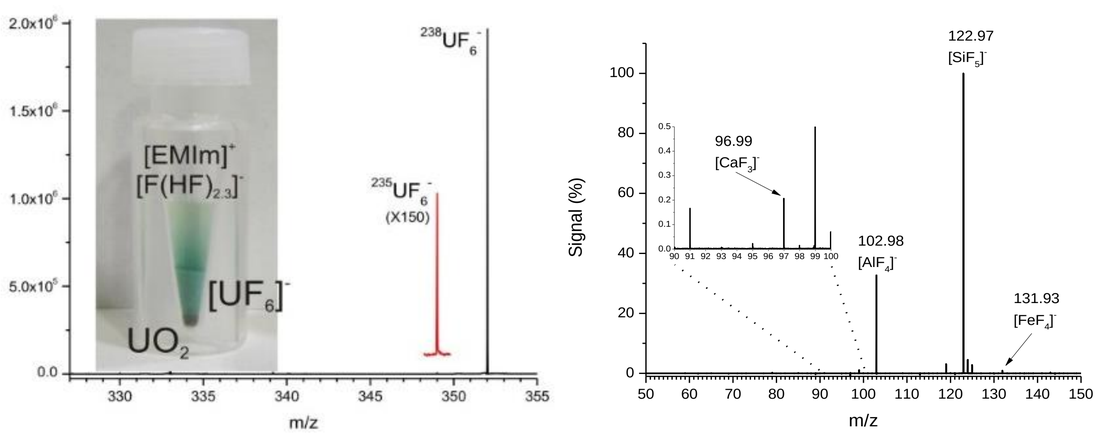
Develop solid materials that have strong dissolution properties

- Allow for sample dissolution in transit from collection to analysis laboratory
- Lower cost and simplify sample preparation

Prior Work

1-ethyl-3-methylimidazolium fluorohydrogenate ($EMImF(HF)_{2.3}$), has been successfully used to dissolve refractory materials, including uranium oxides and debris simulants





Technical Challenge: EMIm-fluoroanion compounds are room-temperature liquids, but Standard Operating Procedure prohibits corrosive liquids

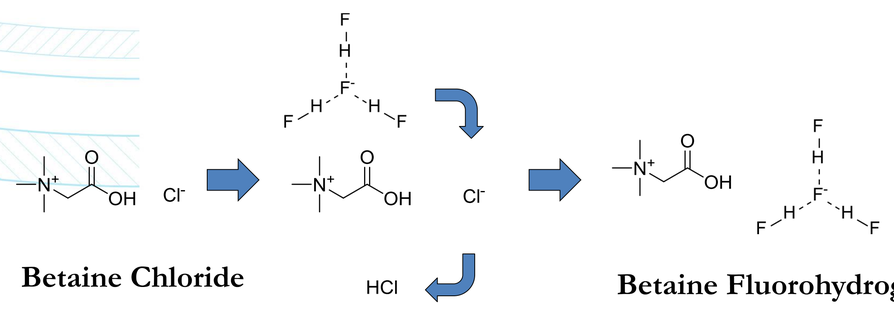
Solution: Synthesize new fluorohydrogenate ionic materials with melting points above 50 °C.

Work supported through the INL Laboratory Directed Research& Development (LDRD) Program under DOE Idaho Operations Office Contract DE-AC07-05ID14517

Approach

Synthesize new ionic chlorides containing cations with increased order, and then replace the chloride with fluorohydrogenate.

- Melting point controlled by cation, dissolution and fluorination controlled mostly by anion

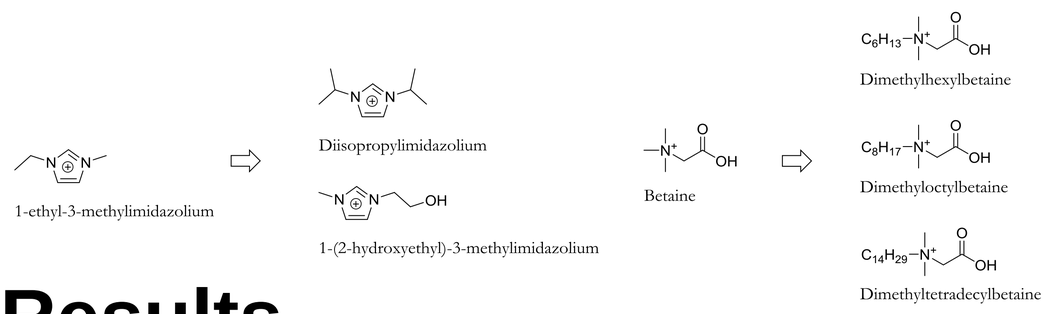


New compounds based on imidazolium cations:

- Hypothesize that these should have similar dissolution properties to $EMImF(HF)_{2.3}$, but with higher melting points

New compounds based on betaine cations:

- Hypothesize that these should have enhanced dissolution properties compared to $EMImF(HF)_{2.3}$, and the melting point will be controlled by tail length



Results

Successfully synthesized three new ionic chlorides based on the betaine cation

Currently converting betaine chloride and diisobutylimidazolium chloride to fluorohydrogenates

Prospects

Developing novel fluorinating ionic materials for rapid debris analysis

- New materials will enable faster, more confident decisions in the aftermath of a nuclear incident

Contributing to the fundamental science of the relationship between ionic liquid structure and physiochemical properties such as melting point

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