Contribution ID : **117** Type : **Oral**

Muti-Scale Dynamic Study on The Amphiphilic Nanostructure of Protic Ionic Liquids

Wednesday, 24 November 2021 16:05 (15)

Ionic liquids are a novel class of solvents with ultra-low vapour pressure and tunable liquid properties. Among them, protic ionic liquids (PILs) are particularly effective solvents for self-assembly of surfactants and lipids into micelles, vesicles, liquid crystals and microemulsions. This is exemplified by alkylammonium PILs, which are also cheap, easily prepared and can be readily deuterated. Over the past decade, much is learnt about the static structure of alkylammonium PILs, however, virtually nothing is known about their dynamics, both the single ion diffusion and the collective motion of clusters. This is due to the complex and disordered nature of liquid nanostructure, which is expected to display a range of dynamic behaviors on different time and length scale. In this study, we have examined ethanolammonium nitrate, ethylammonium nitrate and propylammonium nitrate, using a variety of dynamic techniques. We employed multi-contrast wide-angle neutron spin echo spectroscopy (WASP, ILL) to capture the nanosecond relaxations across 0.1 – 1.4 Å^-1, and pulse-field gradient NMR to track molecular diffusion. Combined with their known averaged liquid nanostructures, we have now characterized the static and dynamic nanostructure of three protic ionic liquids, carefully chosen to demonstrate different degrees of ordering, at multiple temperatures. This allows us to understand the structure-property relationship of alkylammonium PILs across a wide space and time scale, which has the potential to unlock rational design of job-specific PIL-based solvent systems.

Level of Expertise

Student

Presenter Gender

Man

Pronouns

Which facility did you use for your research

None of the above

Students Only - Are you interested in AINSE student funding

Yes

Do you wish to take part in the Student Poster Slam

No

Condition of submission

Yes

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Session Classification : Chemistry, Soft Matter & Crystallography

Track Classification : Chemistry, Soft Matter & Crystallography