

"Pinning down the proton activities of protic ionic liquids and using them to study directed protein misfoldings, fibrillizations, and polypeptide fiber biosyntheses".

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The surging interest in low-melting ionic liquids has mostly centered on the aprotic subclass comprising organic cations. However, chemical versatility is most likely to be found in the protic subclass, PILs. Although the concentrations of protonated species in PILs are all similar, (2-10M compared to the 14 orders of magnitude change between pH 0 and 14 in aqueous systems) the activity of the protons involved in these proton transfer salts can vary enormously. Here the meaning of "activity" is *extra-thermodynamic*, as interest is not focused on a single system in which a standard state can be defined. Each ionic liquid is a separate system. One of the most direct signatures of the Ionic Liquid Proton Activity (ILPA) in which we are interested, is the proton chemical shift for the transferred proton, which is normally attached to a nitrogen base (thus δ -N-H). In this talk we will compare this index with different electrochemically based ILPA indices, and then show how choice of the proton activity can direct the course of chemical transformations, in particular the refolding of protein heteropolymers into unusual amyloid molecules which can then fibrillize. The possibility of applying this principle to homopeptides and related molecules to develop new classes of fibrous materials will be examined.