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Spontaneous Thermoreversible Formation of Cationic Vesicles in a Protic Ionic Liquid DONGCUI LI, CARLOS LOPEZ-BARRON, LEO DERITA, MADIVALA BASAVARAJ, NORMAN WAGNER, University of Delaware
— The search for stable vesicular structures is a long-standing topic of research because of the usefulness of these structures and the scarcity of surfactant systems that spontaneously form vesicles in true thermodynamic equilibrium. We report the first experimental evidence of spontaneous formation of vesicles for a cationic double tail surfactant (didodecyldimethylammonium bromide) in a protic ionic liquid (ethylammonium nitrate) [1-2]. Using small and ultra-small angle neutron scattering, rheology and bright field microscopy, we identify the coexistence of two vesicle containing phases in compositions ranging from 2 to 68 wt %. A low density highly viscous solution containing giant vesicles and a sponge phase coexists with a dilute high density phase containing large vesicles. Vesicles form spontaneously via different thermodynamic routes, with the same size distribution, which strongly supports that they exist in a true thermodynamic equilibrium. The formation of equilibrium vesicles and the L3 phase is facilitated by ion exchange between the cationic surfactant and the ionic liquid, as well as the strength of the solvophobic effect in the protic ionic liquid.

[1] Lopez-Barron et al., J. Phys. Chem. B 116, 813 (2012).
[2] Lopez-Barron et al., J. Am. Chem. Soc., Accepted.

Dongcui Li
University of Delaware

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