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Specific Ion Effects on the Behaviour of a Pluronic Block Copolymer in the Bulk and at the Air/Water Interface

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Specific ion effects are phenomena dependent on ion identity, not merely its valence or concentration. Polymers are frequently used as exemplar systems to investigate specific ion effects,[1,2] where the behaviour of thermoresponsive polymers, such as polypropylene oxide (PPO), is modified by salt. The Pluronic series are block copolymers of hydrophilic poly(ethylene oxide) (PEO) and hydrophobic PPO, arranged in a PEO-PPO-PEO triblock structure; e.g. Pluronic F127.[3] Increasing temperature decreases PPO solubility leading to formation of micelles above the critical micelle concentration (CMC). The temperature at which micelles are formed is dependent on polymer concentration and added ion identity and concentration. The effect of an anion on physicochemical behaviour can be captured through the 'sho' (þ) parameter, an ion's interaction-site specific charge density.[4]
Here we will present data collected using newly designed and commissioned air-liquid trough sample environment for the PLATYPUS neutron reflectometer. An adsorbed layer of F127 at the aqueous solution/air interface was probed as a function of KF, KCl, KBr, KI and KSCN concentration at 22 ℃ and as a function of temperature for KF, KCl, KBr, KI, KSCN, LiCl, LiBr and LiI. Raw reflectivity data demonstrate subtle differences dependent on ion identity and temperature. Analysis using the refnx[5] package reveal changes in the layering of the PEO and PPO blocks in the adsorbed layer.
The bulk aqueous solution structure of F127 has also been characterised with dynamic light scattering and via small angle neutron scattering using QUOKKA. Potassium halides were again used to study impact of anion identity, concentration and temperature on F127 self-assembly and aggregate structure. This experiment further investigated F127 behaviour in complex solutions to investigate if the effective þ value determined in mixed electrolyte can be predicted assuming ideal mixing of the component ions.

References
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Topics

Biological Systems and Soft Matter

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