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**Ion solvation thermodynamics in polymer blends and block copolymers**

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There is much current interest in ion-containing polymers as materials for energy applications. For example, a promising system for rechargeable battery applications consists of diblock copolymers of an ion-dissolving block, typically polyethylene oxide (PEO) and a nonconducting block such as polystyrene. The addition of lithium salts has been shown to significantly alter the order-order and order-disorder transition temperatures, which reflects a change in the miscibility between the two polymer blocks. In this talk, I discuss some simple theoretical ideas for explaining and predicting the change in polymer miscibility due to the addition of salt ions for both polymer blends and block copolymers. A key effect is the solvation energy of the ions by the polymers, which we approximate using the Born solvation model. The difference in the Born energy of the ions between different polymers provides a driving force towards phase separation, whereas the translational entropy of the ions favors keeping the polymers mixed. In the case of lithium salts added to systems containing PEO, we develop a complexation model in which the lithium ions are tightly bound to the oxygen groups in the EO monomers, while the anions can either be free or form ion pairs with the lithium. For PEO-PS blends or block copolymers, we show that adding lithium salts leads to significant increase in the effective $\chi$ parameter between the two polymers. Our theory predicts that the effect should weaken with increasing radius of the anion, in agreement with available experimental data. Furthermore, we show that the domain spacing in microphase separated block copolymers should increase, also in agreement with experiments. We also examine the issue of ion distribution using self-consistent field theory.