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Polyelectrolyte Microcapsules: Ion Distributions from a Poisson-Boltzmann Model[1] QIYUN TANG, ALAN R. DENTON, DAMITH ROZAIRO, ANDREW B. CROLL, Department of Physics, North Dakota State University — Recent experiments have shown that polystyrene-polyacrylic-acid-polystyrene (PS-PAA-PS) triblock copolymers in a solvent mixture of water and toluene can self-assemble into spherical microcapsules. Suspended in water, the microcapsules have a toluene core surrounded by an elastomer triblock shell. The longer, hydrophilic PAA blocks remain near the outer surface of the shell, becoming charged through dissociation of OH functional groups in water, while the shorter, hydrophobic PS blocks form a networked (glass or gel) structure. Within a mean-field Poisson-Boltzmann theory, we model these polyelectrolyte microcapsules as spherical charged shells, assuming different dielectric constants inside and outside the capsule. By numerically solving the nonlinear Poisson-Boltzmann equation, we calculate the radial distribution of anions and cations and the osmotic pressure within the shell as a function of salt concentration. Our predictions, which can be tested by comparison with experiments, may guide the design of microcapsules for practical applications, such as drug delivery.

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