

Polyelectrolytes in multivalent ionic media: New physics and new materials

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Abstract: Multi-valent interactions in systems of polyelectrolytes can exhibit dramatic, non-monotonic effects, for example, switching forces from repulsive to attractive, and back to repulsive again, in some cases. We have been studying these patterns of behavior with the surface forces apparatus (SFA) and with electrochemical methods, such as cyclic voltammetry, which enables the quantitative determination of the number of multi-valent ions residing in thin layers of charged polymers. At fixed ionic strength, all cause strong shrinkage and condensation of poly(styrene sulfonate) brushes over a narrow range of ratio multi-valent to mono-valent ions. When the multi-valent ion is an oppositely charged polymer, new fluid phases can form. Charged blocks in copolymers leads to materials with new types of ordered phases. Effects of these multi-valent interactions on supermolecular and biomolecular assembly will be discussed. There are many possibilities for the creation of new materials based on electrostatic assembly involving multi-valent interactions.



Biography: Matthew Tirrell is the founding Pritzker Director of the Institute for Molecular Engineering at the University of Chicago. Through March 2018, Tirrell simultaneously served as Deputy Laboratory Director for Science and Chief Research Officer at Argonne National Laboratory. Immediately prior to joining the University of Chicago in 2011, he was the Arnold and Barbara Silverman Professor and Chair of Bioengineering at the University of California, Berkeley, with additional appointments in chemical engineering and materials science & engineering, and as a Faculty Scientist at the Lawrence Berkeley National Laboratory. Tirrell received a B.S. in Chemical Engineering at

Northwestern University in 1973 and a Ph.D. in 1977 in Polymer Science from the University of Massachusetts. From 1977 to 1999, he was on the faculty of Chemical Engineering and Materials Science at the University of Minnesota, where he served as department head from 1995 to 1999. Professor Tirrell completed ten years as Dean of Engineering at the University of California, Santa Barbara on June 30, 2009. He has co-authored about 350 papers and one book and has supervised about 80 Ph.D. students. Professor Tirrell is a member of the National Academy of Engineering, the American Academy of Arts & Sciences and the Indian National Academy of Engineering, and is a Fellow of: the American Institute of Medical and Biological Engineers, the AAAS, and the APS. Professor Tirrell has extensive consulting and scientific advisory board experience in both the materials science and biotech/biomedical sectors.

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Where: EP#252