MAR15-2014-001083

Abstract for an Invited Paper
for the MAR15 Meeting of
the American Physical Society

Chirality-selected phase behavior in ionic polypeptide complexes[1]

MATTHEW TIRRELL, University of Chicago

We demonstrate that chirality determines the phase state of polyelectrolyte complexes formed from mixing dilute solutions of oppositely charged polypeptides. In these systems, the physical state of the resultant complex is determined by the combination of electrostatic and hydrogen bonding interactions. The formation of fluid complexes occurs when at least one of the polypeptides in the mixture is racemic, which disrupts backbone hydrogen bonding networks. Pairs of purely chiral polypeptides, of any sense, form compact, fibrillar solids with a β-sheet structure on mixing. Analogous behavior occurs in micellar cores formed from polypeptide block copolymers with polyethylene oxide, where microphase separation into discrete, self-assembled aggregates with either solid or fluid cores, and eventually into ordered phases at high concentrations, is possible. Chirality is an exploitable tool for manipulating material properties in systems based on polyelectrolyte complexation. Its role in these systems gives insight into polyelectrolyte complex phase behavior more broadly.

[1] This work was supported by the U.S. Department of Energy Office of Science Program in Basic Energy Sciences, Materials Sciences and Engineering Division.