Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Phase Transitions in Concentrated Solution Self-Assembly of Globular Protein-Polymer Block Copolymers CHRISTOPHER LAM, BRADLEY OLSEN, Massachusetts Institute of Technology — The self-assembly of globular protein-polymer bioconjugate block copolymers to form biofunctional nanostructures presents potentially complex behavior due to the tertiary structures and specific interactions of protein blocks. To understand the thermodynamics of these systems, the phase behavior of the model globular protein-polymer block copolymer mCherry-*b*-PNIPAM (mChP) is investigated in concentrated aqueous solution as a function of both concentration and temperature. At low concentrations, mChP forms a homogeneous disordered phase at low temperature and macrophase separates into an ordered conjugate-rich phase and a solvent-rich phase at temperatures above the PNIPAM thermoresponsive transition temperature. mChP solutions undergo a lyotropic, low-temperature ODT and both lyotropic and thermotropic OOTs at high concentration. Similar to coil-coil block copolymers, both coil fraction and solvent selectivity have large effects on the morphologies formed—disordered micelles, hexagonally packed cylinders, lamellae, and perforated lamellae. The order-disorder transition concentration (ODTC) of mChP is minimized for symmetric conjugates, suggesting that repulsive solvent-mediated protein-polymer interactions provide a driving force for self-assembly.

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Date submitted: 28 Nov 2012 Electronic form version 1.4