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Ionic Interactions for Aqueous Templating of Biofunctional Molecules in Block Copolymer Nanostructures BRADLEY OLSEN, BOKYUNG KIM, CHRISTOPHER LAM, CHARLOTTE STEWART-SLOAN, EMMANOUIL GKIKAS, Massachusetts Institute of Technology — The use of ionic interactions to direct both biomolecular templating and block copolymer self-assembly into nanopatterned films with only aqueous processing conditions is demonstrated using block copolymers containing both thermally responsive and pH responsive blocks. Reversible addition-fragmentation chain transfer (RAFT) polymerization is employed to synthesize diblock copolymers with one neutral thermoresponsive and one polycationic block and the pH-dependnent complexation between model proteins or biomimetic J-aggregating chromophores and the polycationic block is demonstrated. Spin casting is used to prepare nanostructured films from the protein-block copolymer and chromophore-block copolymer coacervates. After film formation, the lower critical solution temperature (LCST) of the thermoresponsive block allows the nanomaterial to be effectively immobilized in aqueous environments at physiological temperatures, enabling use of the materials for biomolecule immobilization and controlled release. In the case of protein nanotemplating, the ionic environment in which the protein is confined enables the majority of the protein (80%) to retain its activity, even after having been dehydrated in vacuum and confined in the thin film.

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