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**Protonation-induced microphase separation in thin films of a polyelectrolyte-hydrophilic diblock copolymer** CHARLOTTE STEWART-SLOAN, BRADLEY OLSEN, Massachusetts Institute of Technology — Materials with easily and controllably tuneable morphologies are of interest for many applications where the relevant properties depend upon the microstructure. Here, we present a novel double hydrophilic diblock copolymer whose solid state morphology is responsive to protonation. It contains one block which is neutral and hydrophilic at all values of pH, poly(oligoethylene glycol methyl ether methacrylate) (POEGMA), and one block which is neutral and hydrophobic above its pKa but positively charged and hydrophilic when protonated, poly(2-vinylpyridine) (P2 VP). This material is disordered when cast from acid-free solutions but displays increasing segregation between the two blocks with increasing protonation of the pyridine groups. The protonation-induced microphase separation is shown to be due to ionomer-like effects and not to the selective solubilization of ions in one of the blocks. Order-disorder transitions occur between 1:0.28 and 1:0.55 pyridine group:acid content for thin films of a 50kg/mol POEGMA-30kg/mol P2VP diblock and between 1:0.8 and 1:0.9 pyridine group:acid content for thin films of a 43kg/mol POEGMA-13kg/mol P2VP diblock. The latter also displays an order-order transition between spheres and in-plane cylinders between 1:1 and 1:1.1 pyridine group:acid loading. These films can be annealed in aqueous as well as polar organic solvents, allowing for both traditional polymer processing and environmentally friendly water-based casting and annealing.

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