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Spotted Polymersomes and Striped Worms - a theoretical analysis of lateral segregation of diblock copolymers WOUTER G. ELLENBROEK, Department of Physics and Astronomy, University of Pennsylvania, DAVID A. CHRISTIAN, AIWEI TIAN, Chemical & Biomolecular Eng'g and the Laboratory for Research on the Structure of Matter, University of Pennsylvania, ANDREA J. LIU, Department of Physics and Astronomy, University of Pennsylvania, TOBIAS BAUMGART, DENNIS E. DISCHER, Chemical & Biomolecular Eng'g and the Laboratory for Research on the Structure of Matter, University of Pennsylvania — Lipids and amphiphilic block copolymers are both known to assemble into vesicle and worm-like micelle morphologies, but only mixtures of lipids in vesicles have been directly seen to phase separate into meso-scale lateral domains. Here we show direct visualization of meso-scale spots in tough polymersomes and micron-length stripes in stable worms that result from strong lateral segregation of polyanionic and neutral diblock copolymers. We present a model for understanding the crucial role of calcium ions on segregation behavior, which incorporates counterion condensation and "crosslinking" (ion bridging). We find a tendency towards segregation near the isoelectric point as a result of competition among counterion entropy, repulsion due to the net charge, and attraction due to crosslinking. These results portend new classes of robust membranes and cylinders that exhibit lateral patterns at the meso-scale.

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