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Triply-intergrown distorted ths nets: A new tricontinuous equilibrium morphology in copolymeric systems MICHAEL G. FISCHER, Institut fuer Theoretische Physik I, Friedrich-Alexander Universitaet Erlangen-Nuernberg, Staudtstr. 7, 91058 Erlangen, Germany, LILIANA DE CAMPO, STEPHEN T. HYDE, Dept. of Applied Mathematics, Research School of Physics and Engineering, The Australian National University, Canberra ACT 0200, Australia, GERD E. SCHROEDER-TURK, Institut fuer Theoretische Physik I, Friedrich-Alexander Universitaet Erlangen-Nuernberg, Staudtstr. 7, 91058 Erlangen, Germany — Copolymeric self-assembly provides an efficient route to the formation of ordered 3D nanostructures. The most complex equilibrium structure in diblock copolymer melts is the core-shell Gyroid based on the intergrowth of two continuous network domains. Adaption of the molecular architecture is a strategy to achieve different phases, such as kaleidoscopic columnar phases in star-shaped triblock terpolymers. However, the formation of phases based on more than 2 network domains has not yet been reported in copolymer melts. We show that a triply-periodic tricontinuous structure based on the intergrowth of three nets is a stable equilibrium phase of star-shaped triblock copolymers when an extended core is introduced into the molecules. We use self-consistent field theory to confirm the geometric intuitions why the introduction of the core leads to the formation of this new phase. Its effect is a change in the relative importance of interface tension between the three polymeric species and entropic chain stretching to the free energy. This phase is the first tricontinuous network phase in copolymer melts, which has long-range crystalline order but low symmetry.

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