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Kelvin Problem and Sphericity Metric in the Packing Structures of Soft Particles SANGWOO LEE, Rensselaer Polytechnic Institute, CHRIS LEIGHTON, FRANK BATES, University of Minnesota — Attractive hard spheres are known to prefer to form close-packing structures. In contrast, soft particles develop non-close packing structures, e.g., body-centered cubic (BCC), which Kelvin proposed a century ago as the array of densely packed monodisperse soft particles with lowest surface area per unit volume. Remarkably, nearly all packing structures by self-assembled soft particle domains in surfactants, dendrimers, and block polymers are also non-close-packed and appear a set of common symmetries. We found this commonality can be reasoned based on careful observations on the equilibration process occurring in the formation of a Frank-Kasper σ-phase in a poly(1,4-isoprene-*b*-DL-lactide) diblock polymer specimen. The formation of a low symmetry σ-phase occurred by statistically selective mass-exchanges between particle domains, which resulted in volume multiplicity and this process eventually lowered the surface area per unit volume, i.e., better sphericity of particle domains. This example demonstrates that the isovolume condition in the Kelvin problem, which also was assumed in the Weaire-Phelan (A15) structure is not necessary for the natural systems.

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