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Self-Consistent Field Theory of Gaussian Ring Polymers[1] JAEUP KIM, YONG-BIAO YANG, UNIST, WON BO LEE, Sogang University — Ring polymers, being free from chain ends, have fundamental importance in understanding the polymer statics and dynamics which are strongly influenced by the chain end effects. At a glance, their theoretical treatment may not seem particularly difficult, but the absence of chain ends and the topological constraints make the problem non-trivial, which results in limited success in the analytical or semi-analytical formulation of ring polymer theory. Here, I present a self-consistent field theory (SCFT) formalism of Gaussian (topologically unconstrained) ring polymers for the first time. The resulting static property of homogeneous and inhomogeneous ring polymers are compared with the random phase approximation (RPA) results. The critical point for ring homopolymer system is exactly the same as the linear polymer case, $\chi N = 2$, since a critical point does not depend on local structures of polymers. The critical point for ring diblock copolymer melts is $\chi N \approx 17.795$, which is approximately 1.7 times of that of linear diblock copolymer melts, $\chi N \approx 10.495$. The difference is due to the ring structure constraint.

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