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Application of scaling model to investigate solvent quality and functionality in star polymers DURGESH RAI, Oak Ridge National Laboratory, GREGORY BEAUCAGE, University of Cincinnati, RAMANTH RAMACHANDRAN, Procter & Gamble, KEDAR RATKANTHWAR, Swami Ramanand Teerth Marathwada University, NIKOS HADJICHRISTIDIS, King Abdullah University of Science and Technology, HONG KUNLUN, DAVID UHRIG, Oak Ridge National Laboratory, ANDY TSOU, ExxonMobil Research & Engineering Company — Symmetric star polymers serve as model systems to understand branching effects in long chain macromolecules. Generally, the solution properties of stars have been modeled based on ideal Gaussian statistics or using empirical approaches that incorporate fractal scaling neither of which provide satisfactory complete understanding of thermodynamic or structural details across different solvent quality and temperature ranges. A coupling of the unified scattering function with the RPA equation and Benoit's approach to model inter-arm and intra-arm interactions is proposed to analytically quantify thermodynamic effects along with topological variations using the proposed scaling model. Detailed topological quantification of star polymers systems have been able to describe both, good and theta solvent conditions along with effects of functionalities, as well as resolve deviations in chain conformations due to steric interactions between star arms. The scaling model quantifies the distinction between invariant topological features for star polymers and chain tortuosity, which changes with functionality as well as goodness of solvent and steric interactions.

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