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Self-avoiding walk models of random copolymers

Self-avoiding walk models have been used to study linear polymers (long chain molecules) in dilute solution for about 50 years. For such models, the vertices of the walk represent the monomer units which compose the polymer and an edge of the walk joins two monomer units which are chemically bonded together in the polymer chain. Distinct self-avoiding walks on a lattice, such as the square or simple cubic lattice, represent distinct conformations of the polymer chain. Recently there has been much interest in extending the standard self-avoiding walk models of homopolymers (all monomer units considered identical) to the study of random copolymers. A random copolymer is a polymer composed of k types of comonomers, $A_1, \ldots, A_k$, where the specific sequence of these comonomers that appear along the polymer chain is determined by a random process. The monomer sequence can be thought of as being determined in or by the polymerization process (assumed to involve a random process) but then once determined the sequence of monomers is fixed; this is an example of what is known as quenched randomness. In the simplest self-avoiding walk model of a random copolymer, one assumes that $k = 2$ and that the monomer sequence $\chi_1, \chi_2, \ldots, \chi_n$ (for a walk of length n) is such that the χ_i's are independent and identically distributed with $P(\chi_i = A_1) = p$. In this talk, I will review the progress that has been made using self-avoiding walk models to study phase transitions, such as the adsorption phase transition and the localization phase transition, in random copolymer systems.