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Critical behavior of interacting two-polymer system in a fractal solvent: an exact renormalization group approach

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Abstract. We study the polymer system consisting of two polymer chains situated in a fractal container that belongs to the three-dimensional Sierpinski gasket (3D SG) family of fractals. Each 3D SG fractal has four fractal impenetrable 2D surfaces, which are, in fact, 2D SG fractals. The two-polymer system is modeled by two interacting self-avoiding walks (SAW), one of them representing a 3D floating polymer, while the other corresponds to a chain confined to one of the four 2D SG boundaries (with no monomer in the bulk). We assume that the studied system is immersed in a poor solvent inducing the intra-chain interactions. For the inter-chain interactions we propose two models: in the first model (ASAW) the SAW chains are mutually avoiding, whereas in the second model (CSAW) chains can cross each other. By applying an exact renormalization group (RG) method, we establish the relevant phase diagrams for $b = 2, 3$ and 4 members of the 3D SG fractal family for the model with avoiding SAWs, and for $b = 2$ and 3 fractals for the model with crossing SAWs. Also, at the appropriate transition fixed points we calculate the contact critical exponents, associated with the number of contacts between monomers of different chains. Throughout this paper we compare results obtained for the two models and discuss the impact of the topology of the underlying lattices on emerging phase diagrams.

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