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Adsorption of Ideal Polymers on an Infinitely Ramified Fractal

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We study ideal polymer chains interacting attractively with the borders of the lacunas of an infinitely ramified fractal, the Sierpinski carpet. Ideal chains are simulated on finite stages of construction of this fractal at various temperatures. The mean-square displacement and the mean number of adsorbed monomers of N-step chains are estimated in these lattices, and extrapolations to the fractal limit (infinite lattice) consider the exact forms of finite-size corrections as previously predicted by the series expansion method. In the noninteracting case, a finite fraction of the monomers is adsorbed, and this fraction increases as the temperature decreases. However, there is evidence that the critical exponent ν which governs the growth of the chains varies with the temperature in a nonmonotonic way. At high temperatures ν increases with decreasing temperature, and thus the chains are more stretched than in the noninteracting case. At an intermediate temperature, ν starts to decrease and is still positive at very low temperatures, when the chains grow along the borders of several lacunas, occasionally crossing the bulk between them.

KEY WORDS: Polymer adsorption; fractals; numerical simulations.

I. INTRODUCTION

The adsorption of polymers on attractive surfaces is a problem of great pratical importance and has been studied for a long time.[1,2] Statistical models which consider linear polymers on a lattice interacting with a rigid wall succeeded in representing those systems. The general picture which emerged from those studies revealed that the polymer undergoes an adsorption-desorption transition. At low temperatures, the chain grows along the attractive wall with loops in the bulk, and a finite fraction of the

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