

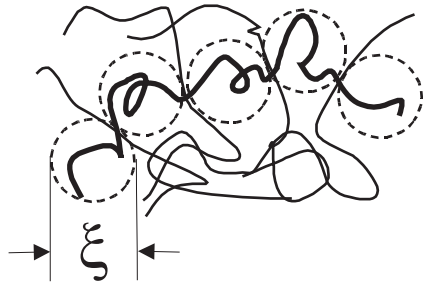
Homework 3

Introduction to Macromolecular Physics

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Problem: Polymer in a semi-dilute solution

We consider one particular, tagged polymer chain (e.g. a deuterated chain) in a semi-dilute solution of other polymers (e.g. non-deuterated polymer chains). Each chain consists of N monomers and the concentration of the monomers per site Φ is in the range of $\Phi^* \ll \Phi \ll 1$. The concentration of the monomers per volume is given by $c = \Phi/a^3$, where a is the size of a monomer. In this situation one can consider the tagged polymer as a chain of blobs. At length scales smaller than the typical blob size ξ , the polymer does not interact with other chains; therefore, within the blobs, the chain can be considered as a swollen chain following the Flory's excluded volume model. At large length scales, the blobs are the basic units and the chain of blobs behaves like an ideal chain: the whole may be considered as a melt of chains of blobs.



1. From the excluded volume model calculate the relation between blob size ξ and number of monomers per blob g . Use this relation to establish the connection between the concentration of monomers per site Φ and the number of monomers per blob g .
2. Calculate the number of blobs per chain.
3. Now you can show that the end-to-end distance R is given by

$$R^2 \simeq a^2 N \Phi^{-1/4} \quad (1)$$