

Studies on the structure - diffusion relationship for polymer membranes with different surface morphology

The relationship between membranes morphology, which is characterized by different parameters, and the characteristics of diffusive transport in the membranes is studied. Membranes comprising of polymer with dispersed inorganic fillers are characterized by polymer matrix density, its fractal dimension, the average size of domains and average number of near obstacles. Diffusive transport is investigated by simulation of a particle motion in the membrane environment. Comparison of diffusion driven by Gaussian random walk and Lévy flights shows that the effective diffusion exponent at long time limit is subdiffusive and it does not depend on the details of the underlying random process causing diffusion. Additionally, the determined ergodicity breaking parameter shows nonergodic behavior in the case of structures that consist of a mix of a large number of small obstacles. Analysis of several parameters describing membrane structure shows that the most important factor for diffusion character is the average size of domain penetrated by diffusing particle. Obtained results might be useful in the design and preparation of the membrane structures with specific diffusion properties.

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