Polymer Viscoelasticity: Basics, Molecular Theories, Experiments and Simulations (2nd Edition)

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This book covers in great detail the Rouse-segment-based molecular theories in polymer viscoelasticity - the Rouse theory and the extended reptation theory (based on the framework of the Doi-Edwards theory) - that have been shown to explain experimental results in a consistently quantitative way. The explanation for the 3.4 power law of viscosity, quantitative line-shape analyses of viscoelastic responses and agreements between different sorts of viscoelastic responses, the consistency between the viscoelasticity and diffusion results, the clarification of the onset of entangelement, the discovery of the number of entanglement strands per cubed entanglement distance being a universal constant and the basic mechanism of the glass transition-related thermorheological complexity are discussed or shown in great detail. The mystery behind the success of the Rouse-segment-based molecular theories over the entropic region of a viscoelastic response is revealed by the Monte Carlo simulations on the Fraenkel chains. Specifically, the simulation studies give a natural explanation for the coexistence of the energy-driven and entropy-driven modes in a viscoelastic response and provide a theoretical basis resolving the paradox that the experimentally determined sizes of Rouse and Kuhn segments are nearly the same. This book starts from a very fundamental level; each chapter is built upon the contents of the previous chapters. Thus, the readers may use the book as a textbook and eventually reach an advanced research level. This book is also a useful source of reference for physicists, chemists and material scientists.

From reader reviews:

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