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Preface

A metastable state is a local free energy minimum which may ultimately relax to the stable equilibrium state with global free energy minimum via an activation process. This process is different from the barrier-free relaxation that spontaneously takes place when an unstable state relaxes. In order to be classified as metastable, the lifetime of a metastable state must be longer than the time scale of observation which is practically limited by experimental equipment and the patience of the observer. In this classical concept of metastable states there is an assumption that the systems are large enough so there is no consideration of size and other kinetic effects on the systems. The notions of metastable states and metastability are not only important in scientific understanding of condensed high polymer physics, but are also useful for practical materials development and applications.

The purpose of this special issue is to utilize the concept and principle of the classical metastable state and metastability to illustrate experimental observations in polymers which exhibit multiple-level relaxation processes. In general, polymers are much more prone to access the metastable region than small molecules. Polymeric materials with their various hierarchies of microstructure may have metastable phases present due to small phase size, composition, external fields and other causes. Experimental observations of metastable states include transient states in polymer phase transformations, polymorphism in crystalline and liquid crystalline polymers, crystal and liquid crystal defects and surface induced order in thin films, supra-molecular structures in self-assembled systems, microdomain structures in polymer blends and copolymers and external field-induced phase metastability occurring during polymer processing, etc.

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