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Doctoral thesis summary

„The influence of cyclic architecture on the physical properties of polymers"

This doctoral dissertation consists of a collection of two thematically related scientific articles published in the peer-reviewed journal *Macromolecules*. The primary objective of this research was to analyze the impact of cyclic architecture on the structural properties of polyelectrolytes and block copolymers. Theoretical studies and molecular dynamics simulations were employed to determine the relationships between the shape, size, and spatial organization of these systems.

The first publication investigates the effect of cyclic topology on the conformation of polyelectrolytes in a good solvent. The results indicate that, unlike their linear counterparts, cyclic polyelectrolytes exhibit a more compact structure at small and intermediate Bjerrum lengths. Additionally, their structural parameters, such as asphericity and prolateness, exhibit non-monotonic behavior, distinguishing them from linear polyelectrolytes.

The second publication explores the influence of cyclic architecture on the self-assembly of block copolymers into periodic nanostructures. It was demonstrated that the presence of cyclic segments leads to a reduction in domain width in lamellar structures, resulting from a more compact organization of monomers. The obtained results align with theoretical predictions and experimental data, highlighting the potential of nonlinear architectures in designing nanomaterials with miniaturized dimensions.

The findings presented in this dissertation underscore the significant role of long-range electrostatic interactions in shaping the conformation of cyclic polyelectrolytes and open new perspectives for polymer engineering, enabling the development of materials with advanced structural and functional properties.