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Macromolecules and deformable drops in linear flows with vorticity: a second conformation transition JERZY BLAWZDZIEWICZ, Yale University — Polymer or DNA macromolecules in an external straining flow undergo a rapid transition between a coiled state and a much more elongated stretched state. This change is due to the interplay between the entropic spring forces driving relaxation of the molecule towards equilibrium and the hydrodynamic forces causing deformation. The coil–stretch transition has a close analogy in the instability of a drop shape when the flow strength is slowly increased to the critical value above which the capillary forces cannot balance hydrodynamic forces. For highly viscous drops in flows with nonzero vorticity there also exists a less known additional transition occurring between two stationary states stabilized either by capillary forces or by rotation. We predict that macromolecules also undergo an additional transformation between a rotationally stabilized nearly undeformed state and a moderately deformed state. Using small-deformation equations for both the drop shape and the conformation tensor of a macromolecule we quantitatively explore the analogy between the dynamics of drops and macromolecules in flows with rotation.

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