

Rheological Models for Wormlike Micelles: Advances, Limitations, and Promising Future Directions

Joseph D. Peterson¹, Weizhong Zou²

¹Department of Chemical and Biomolecular Engineering, UCLA, Los Angeles CA (jdp3@ucla.edu), ²Department of Chemical Engineering, MIT, Cambridge MA

Couplings between polymerization reactions and stress relaxation can be found across a wide range of applications, from flow-induced degradation to reactive extrusion. This coupling is particularly well-studied in living polymers (e.g. wormlike micelles), with early research dating back more than thirty years to Cates' work on reptation and reversible scission. In the intervening period, follow-up research has addressed a broader library of stress relaxation processes and polymerization reaction pathways, leading to a vast but (in our recent experience) often repetitive landscape of models, with rheological predictions being surprisingly well-insulated to seemingly dramatic changes in model assumptions. This talk will review the history of living polymer models and compare early innovations against recent results - both published and unpublished - in order to highlight (1) major advances, (2) emerging limitations, and (3) promising future directions.