MAR16-2015-000376

Abstract for an Invited Paper
for the MAR16 Meeting of
the American Physical Society

Rheology of Rings: Current Status and Future Challenges[1]

GREGORY MCKENNA, Texas Tech Univ

Understanding the dynamics of circular or ring-like polymers has been a subject of investigation since the 1980s and is one which remains an area that is not fully understood [1-5]. Part of the reason for this is the difficulty of making synthetic rings of sufficient size to establish the nature of the entanglement dynamics, if entanglements even exist in these materials. Furthermore, there is now strong evidence that small amounts of linear impurities can impact the dynamics. Hence, one of the major challenges to our understanding of ring dynamics is to make large molecular weight rings of sufficient purity that the dynamics of the rings themselves can be determined. In the present work the current state of understanding of the dynamics of rings is outlined and current work from our group of collaborators [6] to make extremely large circular polymers using Echeverria Coli as a route to make pure rings (circular DNA) in sufficient quantity and size to determine the dynamics of these materials will be shown. First results of ring dynamics in dilute solution are presented and new results on concentrated and entangled solutions will be discussed. Remaining challenges will be elucidated. [1] J. Klein, Macromolecules, 19, 105-118 (1986). [2] J. Roovers, Macromolecules, 18, 1359-1361 (1985). [3] G.B. McKenna, G. Hadziioannou, P. Lutz, G. Hild, C. Strazielle, C. Straupe, P. Rempp and A.J. Kovacs, Macromolecules, 20, 498-512 (1987). [4] M. Kapnistos, M. Lang, D. Vlassopoulos, W. Pyckhout-Hintzen, D. Richter, D. Cho, T. Chang and M. Rubinstein, Nat. Matls., Nat. Mater., 7, 997-1002 (2008). [5] Y. Doi, K. Matsubara,Y. Ohta, T. Nakano, D. Kawaguchi, Y.Takahashi, A. Takano and Y. Matsushita, Macromolecules, 48, 3140−3147 (2015). [6] Y. Li, K.-W. Hsiao, C. A. Brockman, D. Y. Yates, R. M. Robertson-Anderson, J.A. Kornfield, M. J. San Francisco, C. M. Schroeder and G. B. McKenna, Macromolecules, 48, 5997-6001 (2015).

[1]Partially supported by the John R. Bradford Endowment and the Paul Whitfield Horn Professorship at Texas Tech University