A DISCRETE MODEL OF SELF-ORGANIZATION IN STRONG SHEAR FLOWS POLYMER MELTS AND SOLUTIONS

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The analysis of literature data and own experimental observations have led to the conclusion that at high deformation rates viscoelastic liquids (polymer solutions and melts) suffer a transition from a fluid to rubbery-like state. This transition is accompanied by elastic instability which results in formation of regular periodic structures. We suppose that the general explanation of these effects requires the treatment of viscoelastic liquids beyond critical deformation rates as rubbery-like media. Modeling the behavior of these systems is based on the conception that they can be considered as consisting of discrete elements. Such kind of modeling introduces the set of discrete rotators settled on a lattice with two modes of elastic interaction. The first one is the deformation of rotators with their transformation from spherical to ellipsoidal shape and orientation in an external shear field. The second one is the collision of rotators. Computer calculations have demonstrated that this discrete model correctly describes the observed structural effects finally resulting in the "chaos-to-order" transformation. The developed conception can play the central role in the understanding of strong non-linear effects in the rheology of viscoelastic liquids.