Normal stress difference of viscoelastic fluid (PIB/PB based Boger fluid) under large amplitude oscillatory shear flow

남중건, 안경현*, 이승종
서울대학교 화학생물공학부
(ahnnet@snu.ac.kr*)

The dynamic response of viscoelastic fluids under large amplitude oscillatory shear (LAOS) has been a subject of long history. In the LAOS flow, the analysis has been mostly focused on shear stress, possibly due to the lack of accurate measurement of normal stress. However, as the instrumentation advances, it becomes possible to get more reliable data. In this work, PIB/PB based Boger fluid was used to investigate the behavior of normal stress difference under LAOS flow. The elastic(G') and viscous(G") modulus were nearly constant upon the increase of strain amplitude. When Fourier transform was performed, the third harmonic was negligible. But at larger strain amplitude, the first normal stress difference was measurable and was sinusoidal at a frequency twice that of the excitation. It showed a nonzero average value that was equal to the elastic modulus multiplied by the square of the strain amplitude. It was also found that the shape of the first normal stress difference strongly depended on the shear strain and frequency. At higher frequency, they showed asymmetric patterns in contrast to the shear stress.