CHAOS-INDUCED MULTI-SCALE STRUCTURE DEVELOPMENT IN POLYMERIC SYSTEMS

This research utilizes self-similar microstructures of chaotic mixing to obtain unusual morphological forms in the blending of miscible and immiscible polymers and polymers with micro- and nanoscopic fillers. roduced by application of piecewise shear flows

Nevertheless, the overall mixing progresses at exponential rates, reminiscent of unbounded extensional flows. The repeated stretching and folding of material interfaces and alignment of material interfaces along the direction of local stretching are responsib a69c 0.141f uJi1l2-.p unbo0

in the mixed materials. Many of these

entional blending in single and twin screw

mixing highlighted by our work are listed

nto high aspect ratio (>1,000) fibrils by chaotic

nensional stability of the blend materials and

e percolation. For exa

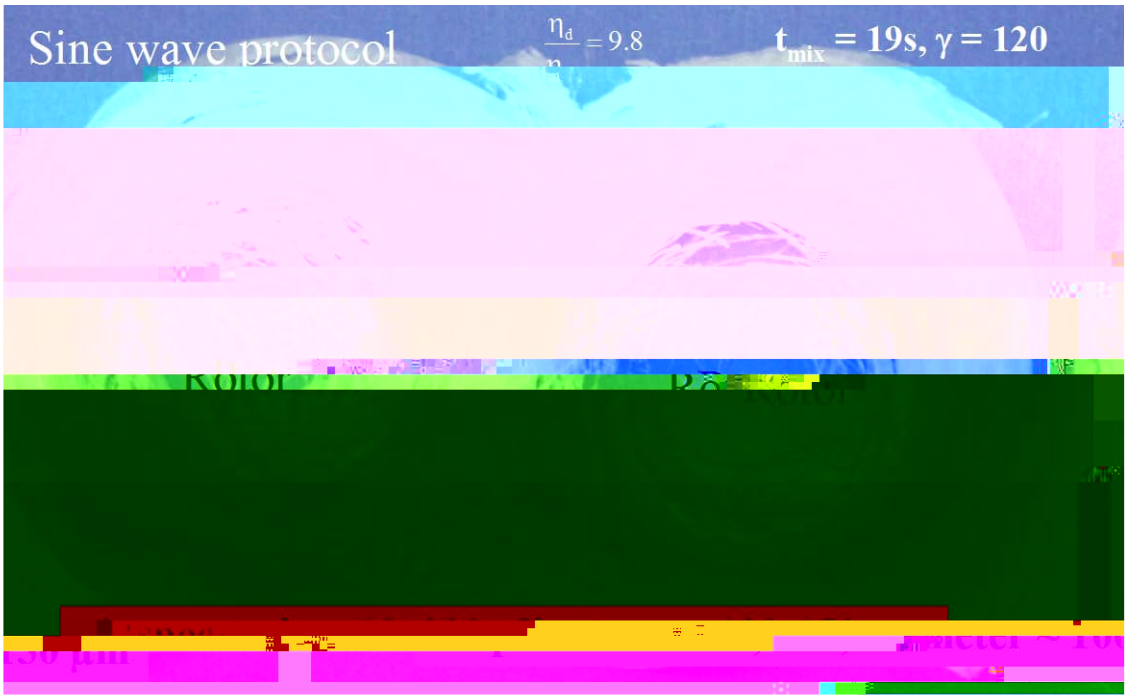

Figure 1. Fibrillar morphology of PP-phase created by chaotic mixing of 10 wt% PP in PA6.

Publications:

1. Dharaiya, D., Jana, S.C., 2005 Nanoclay induced morphology development in chaotic mixing of immiscible polymers. J. Polym. Sci., Part B: Phys., 43(24), 3638-3651.
2. Perilla, J., Jana, S.C., 2005 Coalescence of immiscible polymer blends in chaotic mixers. AIChE J, 51(10) 2675-2685.
3. Perilla, J., Jana, S.C., 2004 A time-scale approach for analysis of coalescence in polymer processing flows. Polym. Eng. Sci., 44(12), 2254-2265.
4. Jana, S.C., Sau, M. 2004 Effects of viscosity ratio and composition on development of morphology in chaotic mixing of polymers. Polymer, 45(5), 1665-1678.
5. Sau, M., Jana, S.C. 2004 Effect of waveforms on morphology development in chaotic mixing of polymers. AIChE J, 50(10), 2346-2358.
6. Sau, M., Jana, S.C. 2004 A study on the effects of chaotic mixer design and operating conditions on morphology development in immiscible polymer systems. Polym. Eng. Sci., 44(3), 407-422.
   Errata "A study on the effects of chaotic mixer design and operating conditions on morphology development in immiscible polymer systems". Polym. Eng. Sci., 44(7), 1403.
7. Sau, M., Jana, S.C. 2003 A study on the effects of chaotic mixer design and operating conditions on the development of morphology in immiscible polymer systems. SPE ANTEC, 61, 1556-1560.
8. Sau, M., Jana, S.C. 2003 Morphology development in PA6/PP system by chaotic mixing: effect of viscosity ratio and composition. SPE ANTEC, 61, 1508-1512.
9. Sau, M., Jana, S.C., 2002 Blending of immiscible polymer systems by chaotic mixing. ANTEC 2002 Proceedings, 60, 1431-1435.

10. Jana, S.C. 2002 Avenues of introducing chaotic mixing in single screw extruders. ANTEC 2002 Proceedings, 60, 1436-1440.
11. Sau, M., Jana, S.C. 2002 Morphology development in immiscible polymer systems by baker's cut. ANTEC 2002 Proceedings, 60, 1446-1450.

(3) We found that droplets are stable against coalescence in the flow field of chaotic mixers. The chaotic trajectories of droplets deter coalescence due to frequent reorientation of the shear direction. Thus finer droplet morphologies generated by chaotic mixing are further stabilized against coarsening and coalescence due to the chaotic trajectories of the droplets. This attributes can be