

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. These structures are produced 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 responsible for the formation of

in the mixed materials. Many of these structures are formed during conventional blending in single and twin screw mixers. The structures highlighted by our work are listed

into high aspect ratio (>1,000) fibrils. The chaotic extensional stability of the blend materials and the percolation. For example

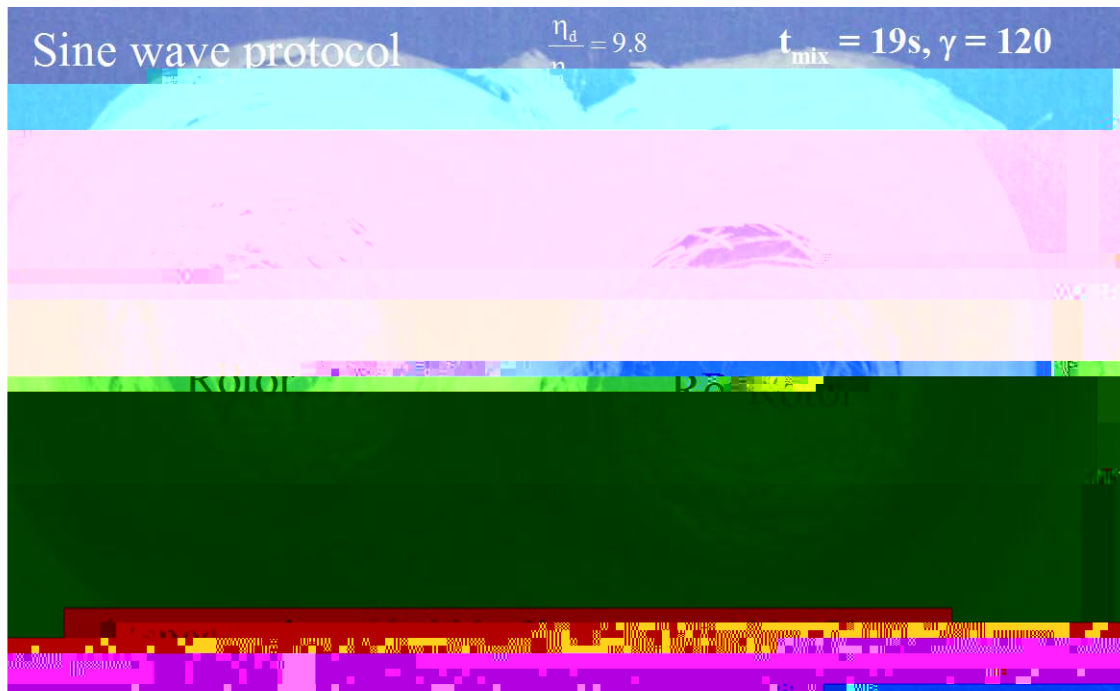


Figure 1. Fibrillar morphology of PP-phase created by chaotic mixing of 10 wt% PP in PA6.

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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.
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9. Sau, M., Jana, S.C., 2002 Blending of immiscible polymer systems by chaotic mixing. ANTEC 2002 Proceedings, **60**, 1431-1435.

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(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