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Doing Things Right with Chaotic Mixing

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In this paper, three examples will be presented from different areas of polymer processing to showcase the useful attributes of chaotic mixing in product and process development research. First example considers chaotic mixers as reactors to produce thermoplastic polyurethanes, where the time scale of mixing can be matched with the time scale of reactions between isocyanates and polyol or short chain diol to produce products with much higher molecular weights and narrower molecular weight distribution than in twin-screw extruders for the same conditions of shear and temperature. In the second example, chaotic mixers are used to produce nanocomposite products of thermoplastic and thermosetting polymers with layered silicate clays and carbon nanofibers. These materials exhibit significant exfoliation and alignment of filler particles and provide dramatic improvements in conductivity and mechanical properties over those prepared in equivalent batch mixers. In the third example we show the influence of nanoscale filler particles on transition from thread to droplet type morphology during chaotic mixing of immiscible polymers.