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MORPHOLOGY DEVELOPMENT OF IMMISCIBLE POLYMER BLENDS DURING MELTING IN SINGLE-SCREW EXTRUDERS: EFFECT OF COMPOSITION AND COMPATIBILIZATION

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The current understanding of the melting stage in single screw extruders results from pioneering research efforts that were initiated in the fifties and continued for more than thirty years on relatively simple polymer systems, such as homopolymers or copolymers. Nowadays, these machines can process complex systems, such as polymer blends, that were either previously prepared in a compounding stage, or that are processed directly into final products, such as monofilaments, tapes and raffia. Many authors have shown that the melting stage is crucial to morphology development and, consequentially, to the final properties of polymer blends. A morphology evolution mechanism for the initial polymer blending stages was proposed by Scott and Macosko (1991) for batch mixers and confirmed by Sundararaj and Macosko (1992) for twin-screw extruders. However, and despite of some efforts (for example, Gosh and Tyagi (2002)), the morphology evolution mechanism and the importance of melting stage on final blend morphology in the case of single-screw extruders, still is not well understood.

This work reports a study of the morphology development, during the melting stage, of immiscible and compatibilized PA6/PP blends with varying compositions, in a prototype modular single screw extruder. The progression of melting is analyzed at various scales, from the presence of solid and melted material, down to the actual morphological characteristics at micrometer level. Generally, the sequence of steps of the mechanisms of morphology evolution proposed for twin screw extruders are observed here, although adapted to the flow kinematics in a single screw channel.

References

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