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Melting of Polymer blends and Concomitant Morphology Development in Single Screw Extruders

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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. Most of these theoretical and experimental studies used homopolymers as model systems, whereas in industrial practice there has been a considerable evolution in terms of the complexity of the materials being extruded. Compatibilized blends are often processed, but immiscible blends are also adopted for some applications. Thus, it is important to unveil the melting mechanism and the associated evolution in morphology prevailing for complex polymer systems, in order optimize the operating conditions or the screw geometry that can yield the required material performance. The influence of the melting stage on the morphology of polymer blends has been studied mostly for twin-screw extruders and batch mixers, a morphology evolution model having been proposed and verified experimentally for the initial stages of blending. Work for single screw extruders is much scarcer and less developed. This work reports an attempt to monitor the melting sequence and the morphology development of immiscible physical and chemically compatibilized PA6/PP blends. A hybrid melting mechanism, incorporating elements of the Tadmor and the Dispersive melting mechanisms seems to develop. The concentration, the melting temperature and the melting rate of the blend components affect the morphology evolution, but the sequences observed are generally in accordance with those reported for twin screw extruders and batch mixers.