G01.20

Ultrasound Assisted Polymer Processing
– Experimental Assessment and Scale up Considerations

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Ultrasound assisted polymer melt processing is a topic of great scientific as well as technological interest to the polymer industry. However, ultrasound assisted melt processing has not been widely developed and used by the polymer processing industry due to various concerns when applying ultrasonic energy to polymer melts. The major concerns are (1) polymer degradation, (2) environmental health and safety (EH&S) issues, and (3) control of the heat generated during the ultrasonic excitation. In this paper, a model family of polymers that contain controlled but various amounts of propylene and ethylene compositions are used to study the degradation mechanism during ultrasound excitation. The effects of ultrasound intensity (amplitude) and energy input (wattage) on the melt properties of polymers are studied. The temperatures increases due to ultrasound excitation measured at various distances from the tip of the horn are also analyzed. The experimental data reveal that the ultrasonic excitation is a localized phenomenon that shows maximum effect on the rheological properties of the polymer melt that is located near the excitation horn ("near field" effects). Scale up considerations and the use of a laser vibrometer to assess long term durability of an ultrasound equipped machine will also be discussed in this paper.