



Sound Approaches to Fluid Movement

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Nowadays Ultrasonics is highly used in in-line Polymer Properties Monitoring (NDT) and Plastic Welding but not as Property Enhancer.

WCBU (Wolfson centre at Brunel University) holds a Patent in USEP (Ultrasonic Enhancement of melt flow for Injection Moulding) and based on the Big Market Opportunity (caused by the reduction of process costs) that the design of similar equipment for the extrusion process could generate the experimental research on the effect of vibrations on the polymer melt has started.

It has been found out the many properties are affected when using ultrasonic waves in an extrusion process.

The Die Temperature rises due to the fact that part of the sound energy is converted into heat energy by the internal friction between the melt molecules and for a given shear rate, the temperature rise is a function of ultrasonic intensity.

The Die Pressure instead reduces since the ultrasound vibration reduces the elastic effect and viscous dissipation of the melt and thus reduces the entrance pressure drop.

Moreover it has been found out that the Apparent Viscosity and the MFR change being that appropriate ultrasonic irradiation can accelerate molecular motion and

make long entangled macromolecular chains unravel with a low degree of degradation.

Knowing that swelling is a relaxation process, energy from ultrasonic irradiation can affect the relaxation of polymer melts by shortening the relaxation time of chain segments, thus decreasing the elasticity of the melt at the die entrance resulting in a decrease on the Die Swell

The effect on the crystalline structure is a bit controversial depending on the power employed for the testing, but generally it can be said that ultrasounds prevent nucleation as well as accelerating the growth of crystal, and the decreased rate of nucleation may lead to lower crystallinity.

The suggested ultrasonic frequency is 24 Hz and the power ranges from 0 to 300W. The direction of the vibrations is both longitudinal and perpendicular to the direction of the flow.

The presence of "BITS" on the surface of the probe assures a bigger contact surface allowing the ultrasonic waves to spread and distribute in every direction in the melt.

At the moment project has been carried out on a Laboratory Scale and using Polyolefines.

The Aim for the future works is to scale it up to the industrial case of PVC Pipe Extrusion.

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