Effect of Ultrasonic Waves on Foam Extrusion

A. I. ISAYEV *and* S. MANDELBAUM*

Institute of Polymer Engineering
University of Akron
Akron, Ohio 44325

The effect of ultrasonic waves upon foam extrusion has been investigated by using a special die attached to an extruder. The die consists of a special ultrasonic horn, having a circular channel, that vibrates at 20 KHz. Various ultrasonic amplitudes and flow rates were employed during extrusion of a foamed polystyrene. Ultrasonic waves were found to affect both die pressure as well as physical and mechanical properties of the foam. Increases in the amplitude of the ultrasonic waves resulted in a decrease of the pressure at the die entrance. The density of the foam was found to increase with an increase of the amplitude and a decrease of the flow rate. Extrudate swell was found to decrease with an increase in the amplitude. Ultrasonic waves also influenced cell size and distribution in extruded samples: increases in amplitude resulted in reduced cell size and in narrowing their distribution. These effects are likely caused by break up of large cells or by disruption of coalescence of small cells. The tensile strength and Young's modulus of samples of extruded foam were found to increase with ultrasonic treatment. A unique correlation of these mechanical properties with the density of the foam was established.