Foam Injection Molding

Using Teledyne ISCO Syringe Pumps

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Syringe Pump Application Note
AN17

Overview

Foam injection molding is an extension of conventional injection molding with foaming. In foam injection molding, an inert gas (i.e., nitrogen, carbon dioxide, etc) is introduced into the polymer melt, and the foamable composition consisting of a single phase polymer/gas solution is injected into the mold cavity to make foamed parts.[1,2] Advantages of foam injection molding include absence of the sink mark on the part surface, better geometric accuracy, weight reduction, low back pressure, faster cycle time, better weldline strength, high stiffness-to-weight ratio, etc.

Teledyne ISCO Syringe Pumps

Since the measure of gas dissolved in the polymer melt governs the cell morphology,[3,4] accurate control of the amount of gas injected into the barrel is the most critical element in the process. Teledyne ISCO Syringe Pumps are excellent pumps for steady, precision gas flow rates in advanced structural foam molding. These pumps deliver reliable feeds in both "constant pressure" mode during the start up phase of the process, and "constant flow" mode throughout the injection process, providing stable, constant gas flow into the polymer melt.

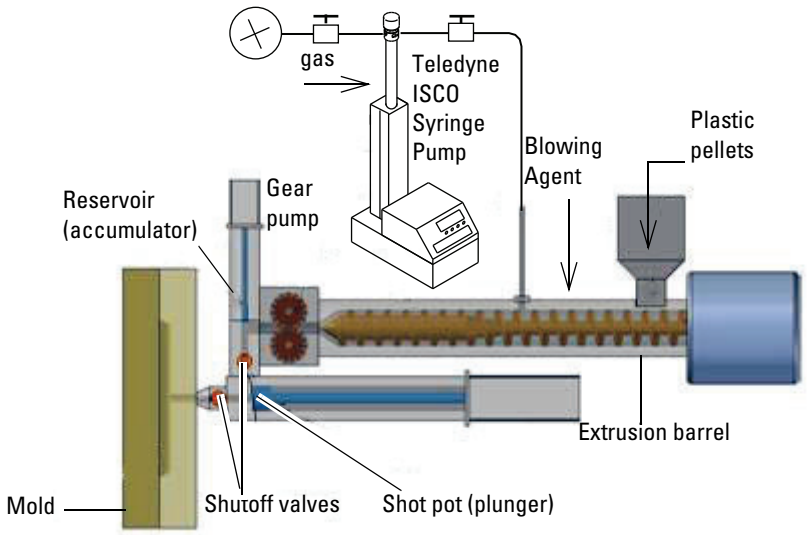

Figure 1: Schematic of Advanced Structural Foam Molding System[1,2]

Advanced Structural Foam Molding System

Figure 1 shows a schematic of the advanced structural foam molding system that has been developed in [our] laboratory. Recognizing that the stop-and-flow molding behavior inevitably causes inconsistent gas dosing, this design allows the flows of the polymer melt and gas to be continuous during the injection period. This machine comprises a positive displacement pump (gear pump) and an additional accumulator between the extrusion barrel and the shut-off valves (one shut-off valve is located before the plunger and the other is located at the nozzle). The design completely decouples the gas dissolution step from the injection and molding operations using the positive-displacement gear pump, and maintains steady-state gas dissolution. During the injection and molding operations, the plasticating screw rotates, and the generated polymer/gas solution is collected in the extra accumulator. After the solution has been subjected to both injection and molding, and has been collected, it moves through the plunger mechanism to be injected into the next cycle. This technology ensures that the pressure in the extrusion barrel is relatively constant and that consistent gas dosing is attained for a uniform polymer/gas mixture regardless of pressure fluctuations in the plunger.[1,2]

Table 1: Commonly Recommended Pumps

	1000x	500x	260x	65x
Flow Range (ml/min)	0.100 - 408	0.001 - 204	0.001 - 107	0.00001 - 25
Pressure Range (psi)	0 - 2,000	0 - 5,000	0 - 9,500	0 - 20,000

REFERENCES

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3) Lee, J.W.S. Wang, J. Yoon, J.D. Park, C.B. "Achievement of Uniform Cell Structure and High Void Fraction in Advanced Structural Foam Molding." Rapra, Blowing Agents and Foaming Processes 2007. Frankfurt, German., 22-23 May 2007.

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Product model names have been updated in this document to reflect current pump offerings.

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