Injection of CO_2 into Plastic Extruders

Using Teledyne ISCO Syringe Pumps

Syringe Pump Application Note AN15

Overview

The use of foaming agents in plastics is common to industries such as insulation, packaging, pharmaceuticals, and automotive. The injection of CO_2 into polymer melts of plastic extruders promises to reduce manufacturing and material costs while eliminating the need for chemical blowing agents, such as chlorofluorocarbons, which can harm the environment.

The Benefits

Environmentally friendly CO_2 can be injected continuously as a supercritical fluid into the hot melt of a plastic extruder, producing medium and low density thermoplastic foams with consistent mechanical properties. Foamed plastics reduce material usage and product weight. Since the raw material of most plastics comes from either crude oil or natural gas, foamed plastics save energy in production and shipping.

The optimization of plastics production requires an understanding of:

- Cell nucleation and growth process
- Solubility of foaming agents
- Pressure/Volume/Temperature (pvT) of polymer gas solutions

Teledyne ISCO Syringe Pumps

Teledyne ISCO Syringe Pumps are excellent for use as CO_2 injection pumps into plastic extruders. These high precision pumps deliver fluids accurately and consistently in either constant flow or constant pressure mode. Continuous flow systems are also available.

At the University of Toronto's Microcellular Plastics Manufacturing Laboratory, research has been ongoing to simulate, understand, and explore solutions for the use of CO_2 in microcellular foamed plastic extrusion and molding applications.

In a typical extruder application, the syringe pump, equipped with a cooling jacket, is connected via a capillary tube to the extruder, as shown in Figure 1.

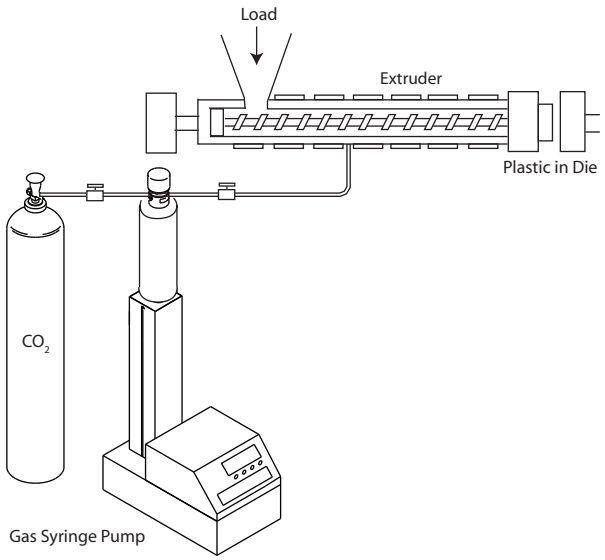

Figure 1: Extruder and pump

The pump is operated in constant flow mode with the cylinder temperature maintained by a cooling bath.

Table 1: Commonly Recommended CO_2 Pumps

	260x	500x
Flow Range (ml/min)	0.001 - 107	0 - 204
Pressure Range (psi)	0 - 9,500	0 - 5,000

REFERENCES:

1) Microcellular Plastics Manufacturing Lab at University of Toronto. 2006. University of Toronto. Feb. 2008 <http://mpml.mie.utoronto.ca/lab/labhome1.htm>.

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

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