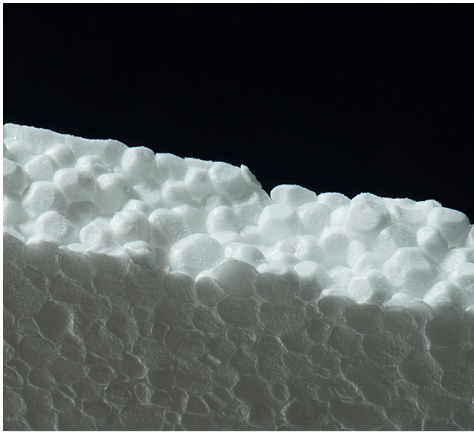


Liquid CO₂ dosing for polystyrene foam extrusion



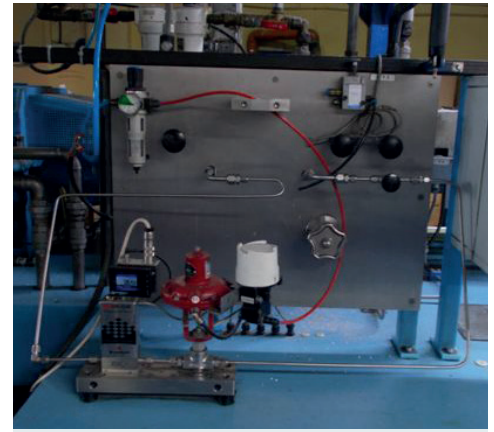
Application note A060-CM06-0117A



Extrusion is an effective technique to manufacture products with a uniform, even complex cross section. The basics of this technique are simple: heat the to-be-extruded material until it can deform somewhat, and force this material to flow through a mould or extrusion head with the desired cross section and shape.

Extrusion of dense polymers results in dense products. However, incorporating a blowing agent in the process will add porosity to the products, leading to low-density and sometimes with excellent acoustic or thermal isolation properties. Non-flammable, non-toxic and cost-efficient chemically inert liquid CO₂ is one of the blowing agents that are used. A needle valve was used in the original setup to dose liquid CO₂ to the extruder. However, the stability of this kind of dosing was poor, and often lead to production breaks. A supplier of Bronkhorst equipment was requested to realise a better solution.

- ◆ Polystyrene foam
- ◆ Polyurethane foam
- ◆ PVC foam



M14 mini CORI-FLOW mass flow controller with Badger valve

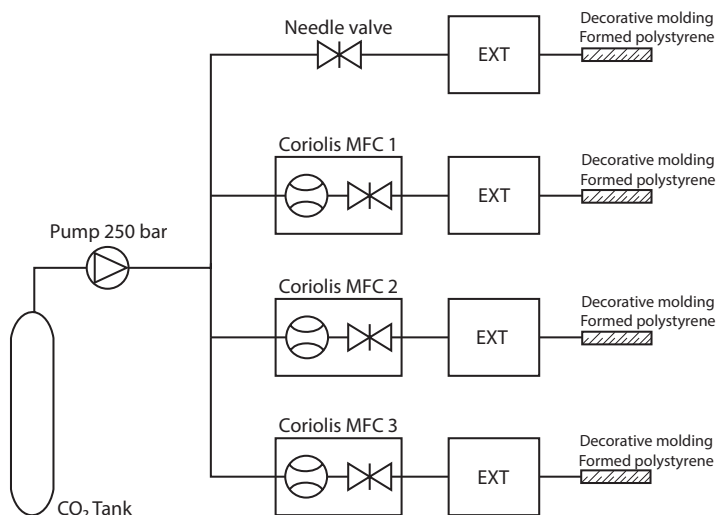
Application requirements

To obtain a uniform polystyrene foam structure, accurate dosing of the liquid carbon dioxide in the presence of a fluctuating extruder pressure is essential. The extrusion process should be continuous - so without production breaks - and stable.

Important topics

- ◆ Stable extrusion process
- ◆ Very few production breaks

Process solution



Flow scheme

An M14 mini CORI-FLOW mass flow controller combined with a Badger valve is the solution here.

By compressing gaseous carbon dioxide at room temperature to more than 50 bars, it becomes a liquid. In the present application, the maximum applied pressure is even 250 bars, and the dosing equipment should be able to handle this pressure. The M14 mini CORI-FLOW mass flow controller is capable of that, and doses 4 to 50 grams liquid carbon dioxide to the extruder, independent of the extruder pressure.

The Badger valve, which is positioned downstream of the M14, is pneumatically controlled. Liquid carbon dioxide expands to its gaseous form when subjected to a lower pressure near the extruder. For this evaporation the carbon dioxide requires heat, which it extracts from the surrounding that cools down. Kalrez seals can not handle the low temperature that is associated with this expansion, so teflon seals are used in the badger valve for this application.

Using this M14/Badger setup, the manufacturer of the decorative polystyrene foam parts has been able to produce several weeks continuously, so the number of production breaks has decreased drastically. ►

As the customer is satisfied, he decided to order two more of these liquid carbon dioxide dosing systems for the other extrusion production lines. ■



Recommended Products



mini CORI-FLOW with Badger valve
The unique design of the miniature Coriolis sensor features unsurpassed performance, even with changing operating conditions in pressure, temperature, density, conductivity and viscosity. Contrary to many other Coriolis flow meters on the market, mini CORI-FLOW offers integrated PID control and close-coupled control valves or pumps.

- ◆ Direct mass flow measurement
- ◆ High accuracy, excellent repeatability
- ◆ Cost-effective design
- ◆ Compact design, with integrated PID controller for fast and stable control
- ◆ Now suitable for (very) low flow ranges
- ◆ Digital technology allows fieldbus communication and offers configurable control characteristics



EL-PRESS
The EL-PRESS series digital electronic pressure transducers and controllers for gases and liquids have a well-proven compact thru-flow design. The instruments include a diaphragm type piezo-resistive pressure sensor for pressure measurement/control from: lowest ranges 2 ... 100 mbar absolute, gauge or differential up to highest ranges 8 ... 400 bar absolute / gauge or 0,3 ... 15 bar dif.

- ◆ Thru-flow design
- ◆ Compact arrangement
- ◆ Stable control, even at varying process volumes
- ◆ High pressure capability up to 400 bar
- ◆ Metal sealed and/or down-ported versions available
- ◆ High accuracy and repeatability



IN-FLOW
IN-FLOW Select Series Mass Flow Meters/Controllers are thermal, bypass-type, mass flow meters of modular construction with a 'industrial style' pc-board housing. Control valves can either be integrally or separately mounted, to measure and control gas flows from lowest range 0,014 ... 0,7 ml/min up to highest range 8 ... 1670 l/min.

- ◆ High accuracy
- ◆ Rangeability in digital mode up to 187,5 : 1
- ◆ Optional Multi-Gas / Multi-Range functionality:
- ◆ Pressure rating 64 / 100 bar (Multi-Gas / -Range functionality)
- ◆ Rugged, weatherproof housing
- ◆ Analog or digital communication (RS232 or fieldbus interface)

Contact information



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A060-CM06-0117A

CM: Chemical, Metal & Glass

06: Plastics

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