



## Gases in the plastics industry

**Carbon dioxide and nitrogen are increasingly being used as environmentally friendly blowing agents for different industrial foaming processes. Linde not only manufactures these gases but complements them with supply solutions for customers.**

### Inert gases – the environmentally sound alternative

The Montreal Protocol from 1989 is a multilateral treaty that has been ratified by around 200 countries worldwide. The protocol obliges signees to reduce and ultimately eliminate substances that deplete stratospheric ozone, more commonly known as the ozone layer. Chlorofluorocarbon (CFC) is one compound that is covered by this regulation. The drastic drop in CFC emissions worldwide is certainly a direct result of this international treaty.

Linde was one of the forerunners in developing metering applications aimed at successfully deploying the inert gases carbon dioxide and nitrogen as more environmentally sound alternatives to these harmful gases in the plastics industry.

Previously, CFC was used as the blowing agent to create foamed polymers' characteristic cellular structure. Since demand for foamed plastics remains high among a diverse range of industries and end-users, eco-friendly production is of key importance.

The benefits of foamed plastics are indisputable. Low density, excellent heat and sound insulation, mechanical damping, low water vapour permeability and reduced humidity absorption are just some of their valued properties. Today, foamed plastics are manufactured in a more eco-friendly way with carbon dioxide and are key products for a wide range of sectors including the packaging, construction and automobile industries. They are also used in the production of insulating material, furniture and mattresses. There are many different types of foamed plastics and manufacturing processes.

### Recycled CO<sub>2</sub> for mattresses

The decision to use chemical or physical blowing agents depends on the process in question and the required density of the end product.

Chemical blowing agents are mixed with the plastic pellets. They then dissolve at higher temperatures, usually separating into nitrogen (N<sub>2</sub>) or carbon dioxide (CO<sub>2</sub>). These gases then act as blowing agents. The disadvantages of this procedure are its unwanted by-products and the often high cost of the chemical blowing agents themselves.

In contrast, physical blowing agents are metered into the plastic melt. In other words, added to one of the initial products.

Using the inert gases nitrogen (N<sub>2</sub>) or carbon dioxide (CO<sub>2</sub>) as substitutes for banned CFC has many benefits. Carbon dioxide is a very cost-efficient solution as it is inexpensive and efficient in consumption, ensuring rapid return on investment for CO<sub>2</sub> loading systems. CO<sub>2</sub> also has a low level of reactivity, is non-flammable and non-toxic, and therefore does not leave behind any residue in the foamed product. Furthermore, carbon dioxide is not an ozone depleting substance, nor is it produced explicitly for the plastics industry. The CO<sub>2</sub> used here is the recycled by-product of other production processes, which is purified, dried and liquefied under pressure by Linde before use.

**HOME**

**ABOUT THIS REPORT**

**FUNDAMENTALS**

**FIELDS OF ACTION**

**DIVISIONS**

**Gases Division**

**Recycling with liquid**

**nitrogen**

**Gases in the plastics industry**

**Using gases in the**

**construction industry**

**Biological wastewater**

**treatment**

**Gases for solar cells**

**Cleaning with CO<sub>2</sub> snow**

**Pain relief**

**Healing with oxygen**

**Pure oxygen for fish farming**

**Transport cooling**

**CO<sub>2</sub>-Snow for foundries**

**Oxygen increase efficiency**

**Cleaning with CO<sub>2</sub>**

**Oxygen in paper production**

**Engineering Division**

**ROADMAP**

**GRI INDEX**

**ASSURANCE REPORT**