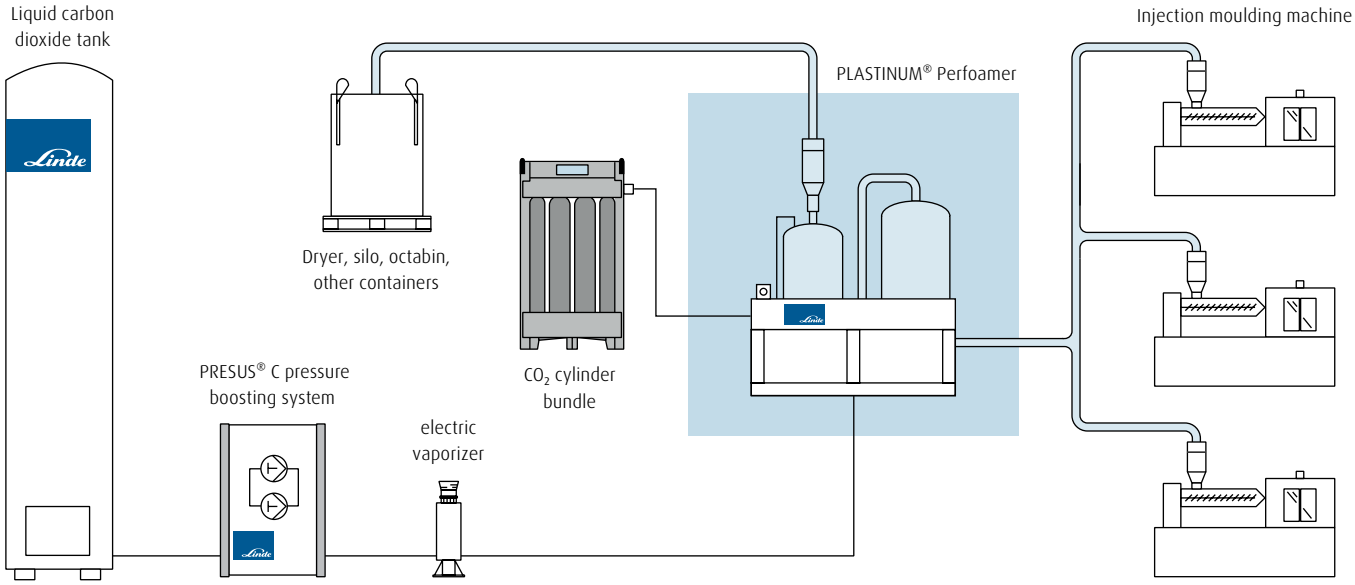
Making our world more productive

PLASTINUM® Foam Injection Moulding solutions

Bringing simplicity and flexibility to physical foaming

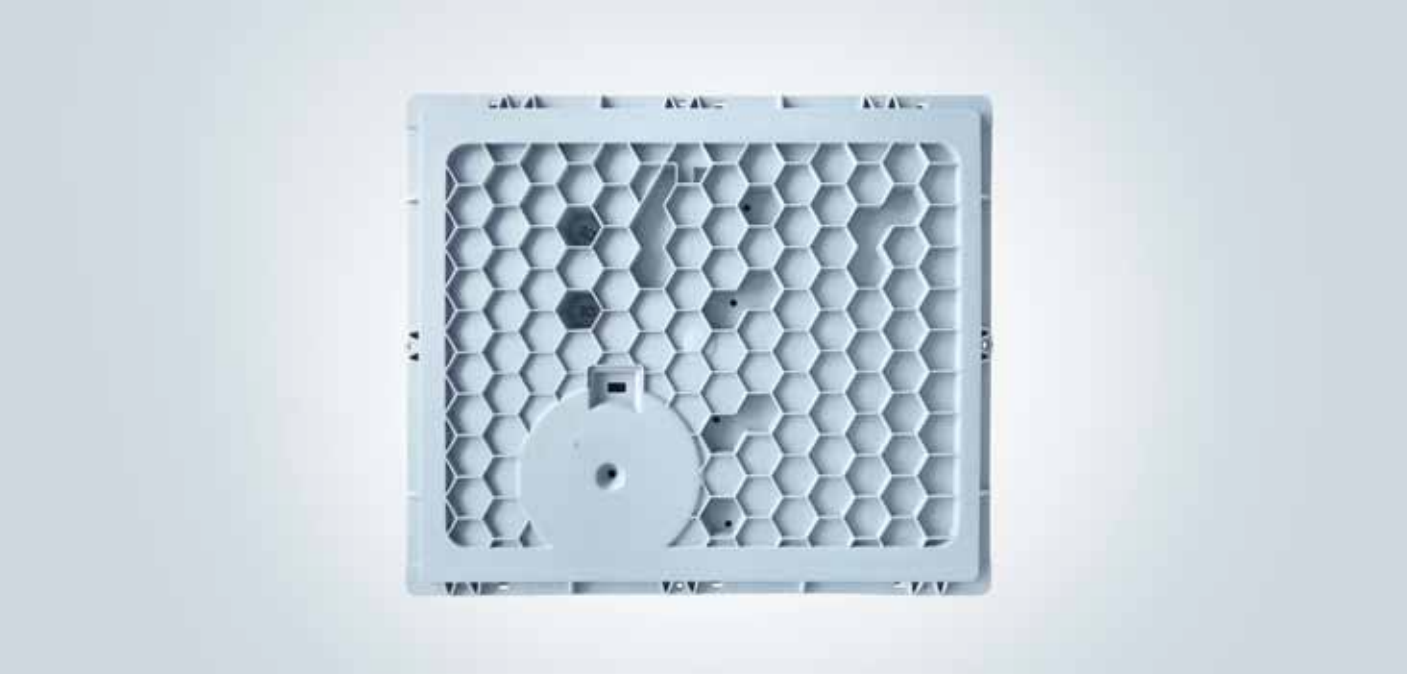


The lightweighting trend

Demand for plastics is rising worldwide, driven in particular by the lightweighting trend in industries such as automotive. Here, thin-walled, lightweight precision parts are increasingly replacing metal or alloy alternatives. Foaming is an effective way to reduce the weight of injection-moulded parts. It also offers cost advantages as it lowers the amount of plastic granulate required to manufacture a part.

In addition, foam injection moulding can optimise the injection process by lowering viscosity, improving melt flowability, accelerating cycle times by up to 50 percent and lowering clamping pressure by up to 60 percent. And homogenous gas distribution enhances quality by creating moulded parts with uniform and dimensionally stable shapes.

Computer fan and outer casing of headphones produced using foam injection moulding



Base plate of a washing machine produced with PLASTINUM Foam Injection Moulding. Material: PP 30% talcum reinforced, Weight reduction: 8%

The chemical/physical dilemma

Up until now, manufacturers have had to choose between physical and chemical foaming techniques. With chemical processes, a foaming agent is mixed with the plastic granulate. Easy to handle, this process can be installed on standard injection moulding machines. However, unlike physical foaming processes, chemical techniques only enable low foaming pressures, making them ill-suited to plastics with thin walls. They also leave residue on the foamed part or on parts of the moulding machine such as the screw. In addition, chemical blowing agents are costly.

With physical blowing techniques, the blowing agent is typically mixed with the granulate or melted polymer directly in the moulding machine. This requires additional modifications to the injection moulding machine and a special screw to ensure homogeneous mixing with the polymer melt. A high-pressure gas dosing unit for controlled gas injection is also required. This pushes up installation costs and limits flexibility. Advantages include lower foam densities, lower blowing agent costs, the absence of residue in the mould and the higher foaming pressures necessary for the production of thin-walled parts.

Advantages of physical foaming compared with chemical foaming

- → Greater weight reductions
- → Less shrinkage, distortion and warpage
- → Possibility to also produce thin-walled and lightweight precision parts measuring less than 2 mm
- → Ideal for foaming high-tech plastic parts

Best of both worlds

Linde teamed up with Kunststoff-Institut Lüdenscheid (KIMW) and ProTec Polymer Processing GmbH to develop a solution combining the best of both worlds. PLASTINUM® Foam Injection Moulding technology combines the benefits of simple chemical foaming with the efficiency gains of physical foaming.

Based on defined conditions (temperature and residual moisture level) the plastic granulate is impregnated with the blowing agent carbon dioxide (CO_2) in the pressurised impregnation unit of the PLASTINUM Perfoamer equipment. The gas diffuses into the granulate under pressure and over time. This extra process step takes place upstream of the injection moulding machine so it maximises installation flexibility.

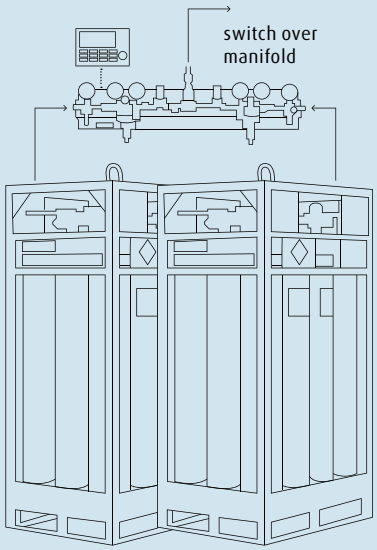
The amount absorbed by the granulate depends on the plastic material, pressure, temperature and impregnation time.

The autoclave vessel is then depressurised and the plastic granulate is transferred to a pressurized buffer tank. The pressure of 5–8 bar in the buffer tank prevents the desorption of the CO_2 which guarantees highly stable reproducible foaming results. From the buffer tank, the granulate is fed to one or multiple injection moulding machines. In the plastification unit the blowing agent CO_2 is dissolved in the melt during plastification and forms microcellular gas bubbles with the pressure relief during the injection process.

Benefits of PLASTINUM foaming at a glance

- Suited to all conventional injection moulding machines
- Ease of installation on both new machines and retrofits
- Almost no need to modify existing injection machines – shut-off nozzle and screw position control is all that is required
- Flexible solution – can be switched between different injection moulding lines or production sites
- Increased productivity – PLASTINUM Perfoamer can supply multiple injection moulding machines in parallel (depending on the throughput)
- Potential for large weight reduction of up to 50% for many polymers (depending on wall thickness, geometry, required mechanical properties, mould technology) as a high amount of CO_2 can be absorbed

PLASTINUM® Perfoamer



Switch over manifold and CO_2 bundle

All-in-one package

The PLASTINUM Foam Injection Moulding system comprises a number of components and complementary systems that allow plastics manufacturers to quickly and easily integrate physical foaming technology upstream of existing injection moulding equipment. These include:

- The PLASTINUM Perfoamer system consists of an autoclave vessel for impregnation and a pressurized buffer tank for the granulate
- Gas supply scheme to suit individual volume needs – scaling from bundles to bulk tanks
- PRESUS® C family of cost-effective pressure-boosting units ideal for CO_2-based moulding processes (based on bulk supplies)
- Dedicated gas manifold that automatically switches from empty to full cylinder bundles to ensure continuity of supply
- Mobile design – quick changeover between machines
- Rapid deployment – few or no modifications to the IMM required (shut-off nozzle and position control for screw are required)
- Flexibility – can also be used with shear-sensitive thermoplastics (polyoxymethylene (POM), long fibre reinforced thermoplastics (LFRT), etc.)
- Cost efficiencies – significant reduction in investment costs compared with alternative physical foaming technologies

All-round service and support

We offer a full scope of services to ensure you invest in the technology package that works best for you and delivers maximum optimisation benefits. You can rely on us for:

- Material screening tests to assess the CO_2 absorption and desorption rate of your polymer and evaluate expected foaming results
- Feasibility assessments and foaming tests on your polymers using standard moulds in collaboration with our partner KIMW
- On-site trials using your polymer and mould, evaluating foaming results and the resulting part
- Weight reduction analysis plus part geometry and mould engineering optimisation recommendations
- Implementation and commissioning of your PLASTINUM foaming solution
- Automatic gas supply solutions
- Operator training and documentation
- Aftersales support, including process optimisation consulting in collaboration with KIMW, preventative maintenance, training updates as well as monitoring, measuring and adjusting of equipment

More Information

For more information about PLASTINUM Foam Injection Moulding, please contact your local Linde representative, email us at plastics.rubber.team@linde.com or visit www.linde-gas.com/plastinum

Partners in focus

KIMW

Kunststoff-Institut Lüdenscheid (KIMW), established in 1988, is certified to DIN EN ISO 9001 and has been equipped with an accredited test lab according to DIN EN ISO/IEC 17025 since 2000. The company is a renowned plastics institute in Germany and Europe.

It combines state-of-the-art scientific knowledge with today's manufacturing processes, focusing on ways to improve the quality and the profitability of companies in the plastics industry, especially in the area of injection-moulded parts made of thermoplastic and thermoset materials. KIMW is co-inventor of the PLASTINUM® Foam Injection Moulding process and consults with customers when implementing the new process into production.

KUNSTSTOFF INSTITUT LÜDENSCHEID

ProTec

ProTec Polymer Processing GmbH, headquartered in Bensheim, Germany, is an international one-stop supplier to the plastics industry. ProTec is a leader in materials handling, polymer treatment, recycling and complete systems for producing long fibre reinforced thermoplastics. ProTec collaborates with Linde to build the PLASTINUM® Perfoamer system for the PLASTINUM® Foam Injection Moulding process, which is then integrated into the customer's injection moulding system.

ProTec Polymer Processing

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