




CHEMICAL FOAMING AGENTS (CFAS) / BLOWING AGENTS

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The background of the slide features a dark, blue-tinted image of a person wearing safety glasses and a hard hat, working in an industrial environment. On the right side, there is a vibrant, multi-colored powder explosion in shades of pink, orange, yellow, and green. The main text is overlaid on the left side of the image.

We develop high-quality materials to improve the appearance, **performance**, **value** and **sustainability** of plastic mouldings.

MASTERBATCH / COMPOUNDS / ROTO POWDER

WHY USE A BLOWING AGENT?

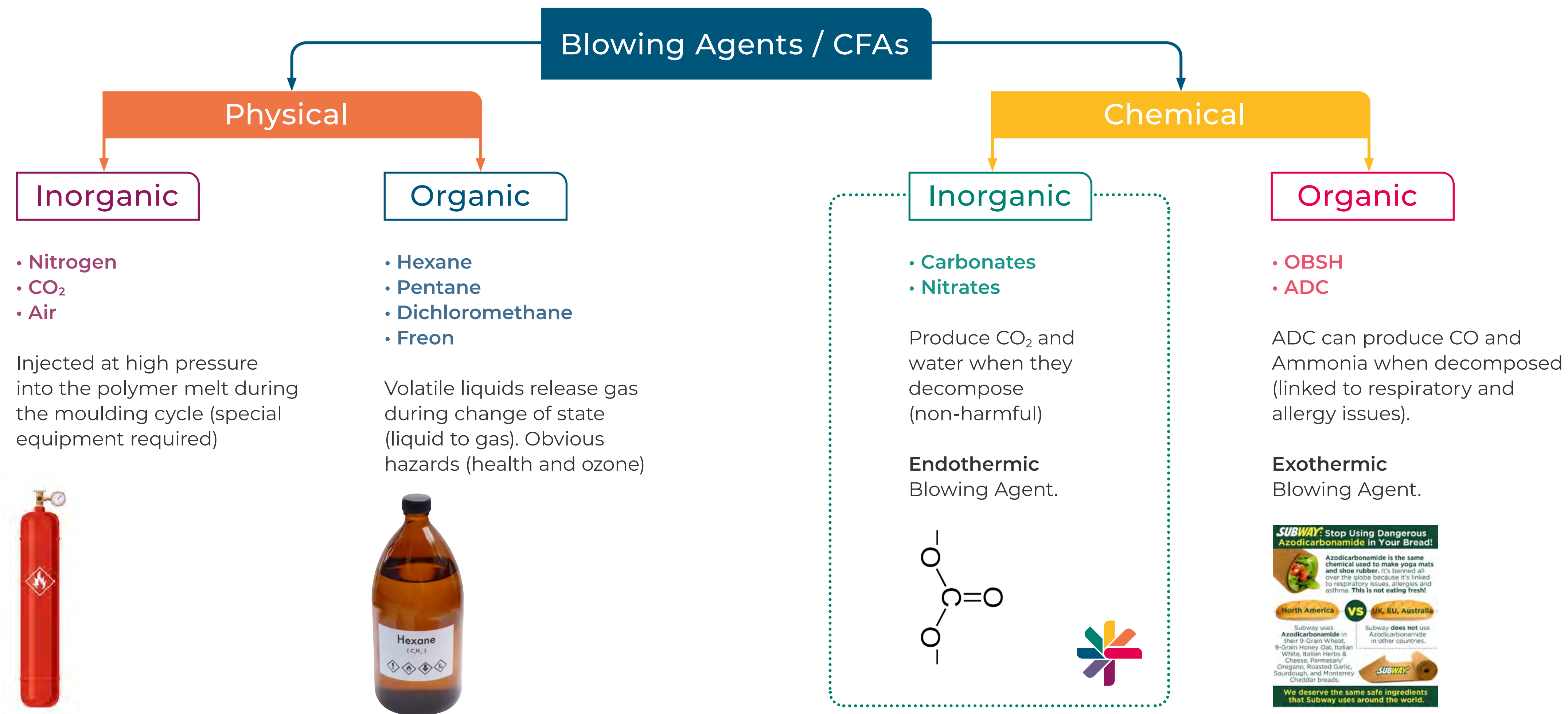
A blowing agent is a substance which is capable of producing a **cellular structure** via a foaming process.

Benefits of use in injection moulding may include:

- ✓ Reduction in weight of the moulded component
- ✓ Reduced material usage
- ✓ Reduction in costs without any tooling changes
- ✓ Prevention of sink marks
- ✓ Increased shot speed and reduced cycle times
- ✓ Improved strength-to-weight ratio
(dependent on polymer grade and additive dosing)
- ✓ Improved thermal efficiency of the final part
- ✓ Improved acoustic insulation of the final part



CLASSIFICATIONS



EXOTHERMIC VS ENDOTHERMIC

‘Exo’



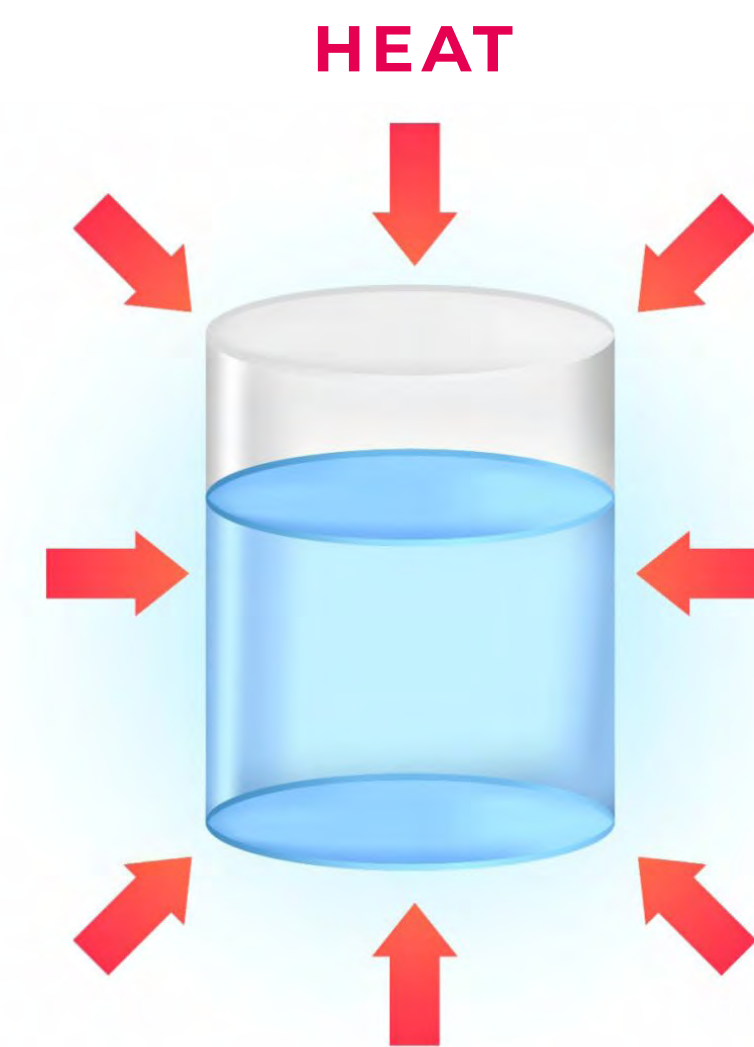
Exothermic blowing agents:

They release energy during reaction (can cause temperature ‘run-away’).

Typically generates N_2 and CO_2 when decomposing but can also generate **Ammonia** and **CO** when decomposed (health and safety considerations).

Usually, high gas yield and pressure of gas released.

‘Endo’



Endothermic blowing agents:

They absorb energy during reaction (easy to control).

Typically release **carbon dioxide** and **water** only upon decomposition.

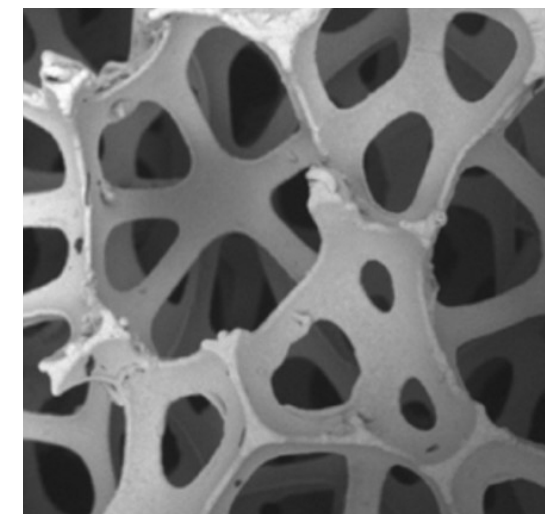
BLOWING AGENTS – THE BENEFITS

Reduction in weight of the final part

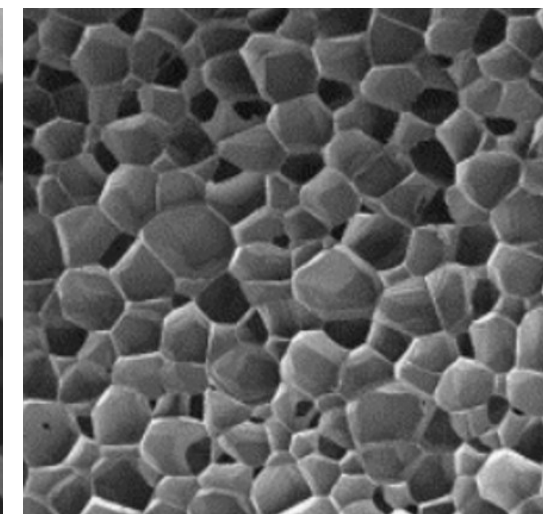
The creation of a cellular structure in the polymer, **reduces its density**.

This in turn reduces the overall weight of polymer in the final moulded part.

Open Cell



Closed Cell



Improved thermal efficiency of final part

The gas trapped within the cell structure has a lower thermal conductivity than the solid polymer.

This decreases the rate at which heat is transferred through the material, keeping the contents of the foamed material hotter (or cooler) for longer.



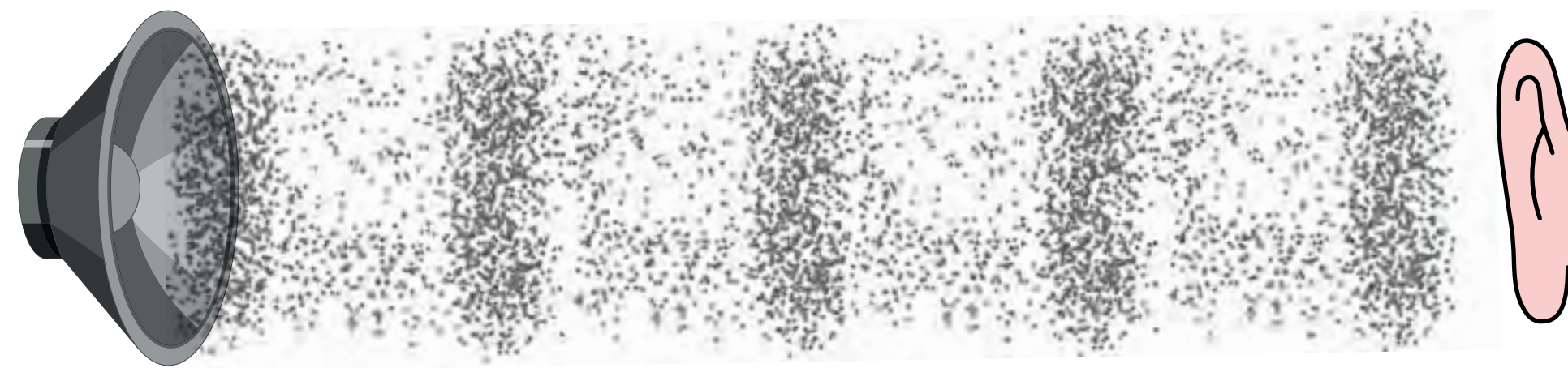
Material Conductivity

Air	0.024 W/mk
LDPE	0.30 W/mk
HDPE	0.44 W/mk
PP	0.11 W/mk
PET	0.15 W/mk

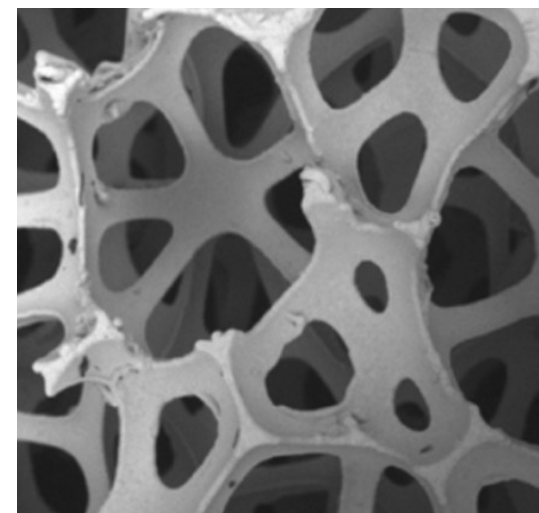
BLOWING AGENTS – THE BENEFITS

Improved acoustic insulation of final part

Sound waves travel as longitudinal waves, causing compressions of air particles. The foamed structure, disrupts (attenuates) the movement of the sound wave.



Open Cell



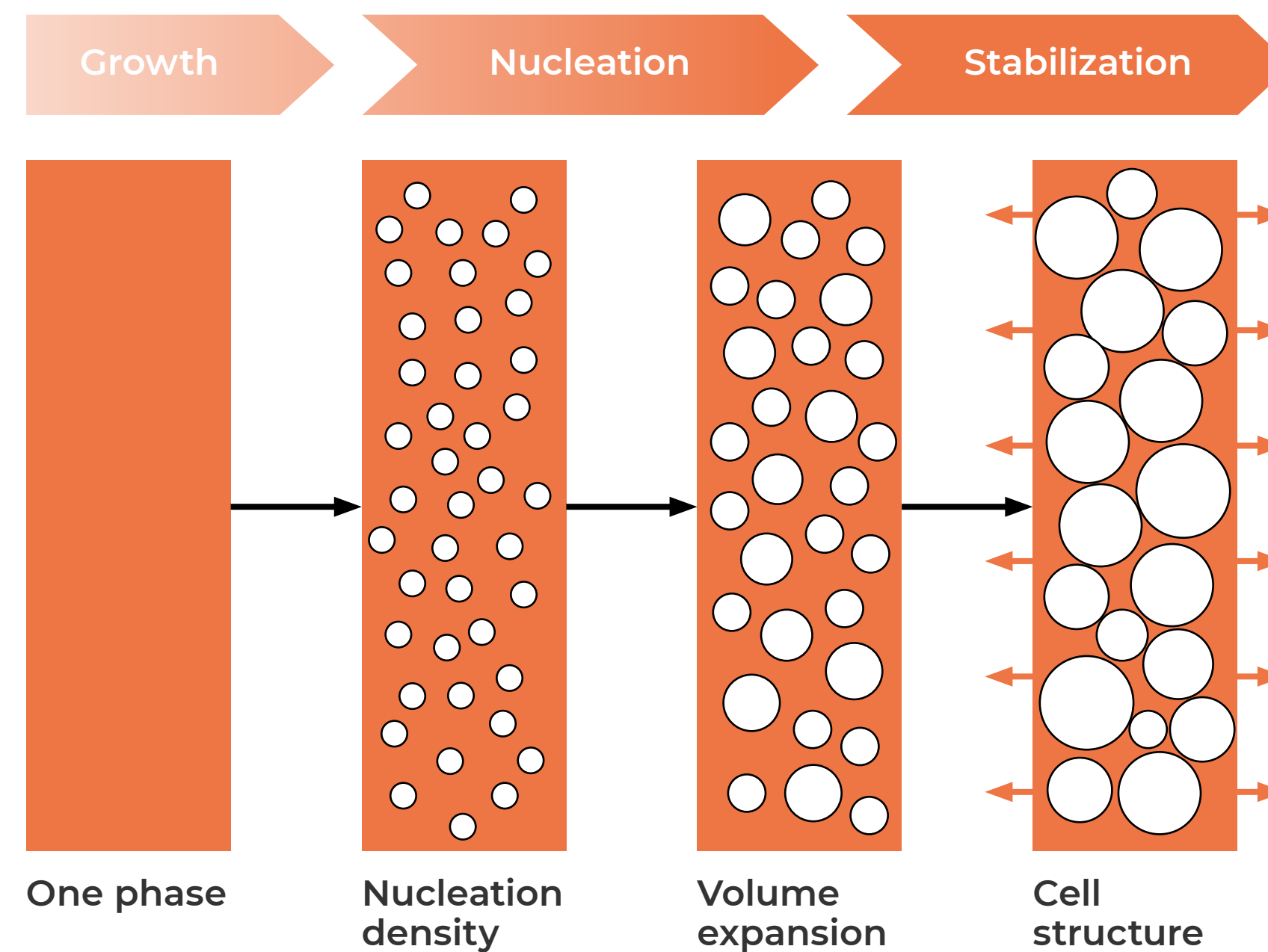
Open-cell foam is a porous substance of connected, open cells. It's less rigid than closed-cell, allowing for some air and moisture infiltration. Because of the open structure, it's better at trapping sound.

BLOWING AGENTS – THE BENEFITS

Prevention of sink marks

The foam expands while the thermoplastic is cooling in the mould. This process offsets the tendency for the moulded part to shrink (thermal contraction) whilst cooling, thus mitigating against possible sink marks.

STAGES OF FOAMING



BLOWING AGENTS – THE BENEFITS

Increased shot speed, reduced cycle time

Viscosity (resistance to deformation) of the blowing agent/polymer melt is lower than just polymer on its own (due to bubbles beginning to form in the melt allowing for deformation). This lower viscosity results in a smoother, quicker injection stage and reduced cycle time (overall).

Increased shot speed as the polymer must be 'short shot' into the mould (i.e. less polymer added), to allow the melt room to foam within the mould.



INDUSTRY PARTNER TRIALS - PCR CAP MOULDING

Key Project Factor: Cost

Since the introduction of the packaging tax rPP(PCR) is now more expensive than virgin.

Options and considerations for cost reduction:

Thin Walling

- Tooling modification costs
- Changes dimensions
- No ongoing costs
- Changes are permanent
- Potential production issues

Chemical Foaming

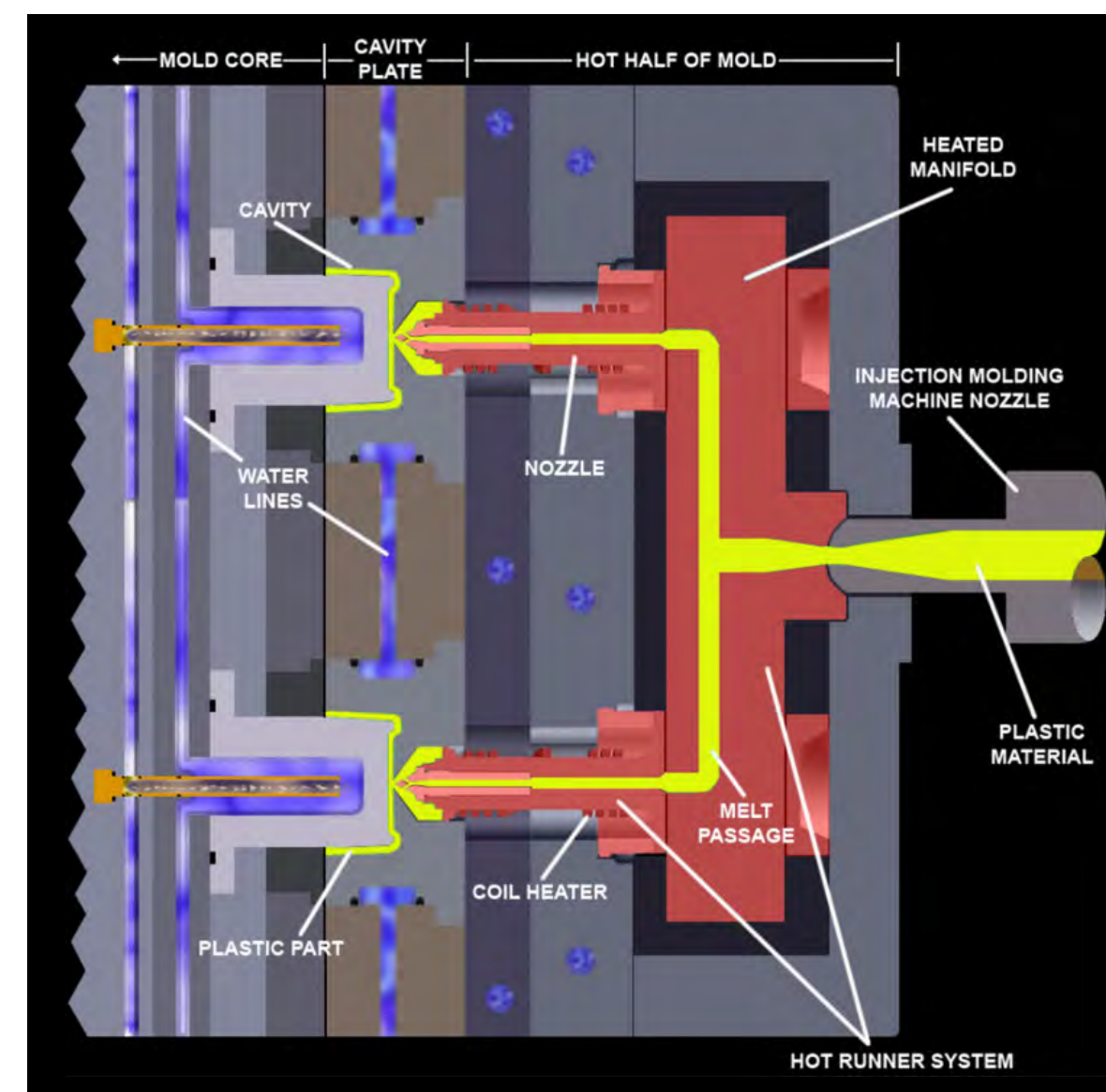
- Zero tooling costs
- No/few dimensional changes
- Ongoing additive costs
- Can be turned on and off
- Successfully trialled



INDUSTRY PARTNER TRIALS - PCR CAP MOULDING

Method

- 0.5% LD of SCM51927 in PPHP• Shut-off nozzle and valve gates on hot runner
- Good mould venting
- Fast injection speed
- Holding pressure as low as possible (ideally zero)
- Gradually decrease 'switch over' point as holding pressure is decreased
- Optimised temperature profile



INDUSTRY PARTNER TRIALS - PCR CAP MOULDING

Results

Optimum foam density for SCM51927 (at 0.5 % LD in PPHP),
observed using flat temperature profiles between 210 – 250 °C

Average Weight Loss in Final Cap (compared to control)

(210 °C flat profile) = 8.0 %

(250 °C flat profile) = 8.5 %

Average Dimensional Variation (from control)

Cap Height

(210 °C flat profile) = 0.44 %

(250 °C flat profile) = 0.43 %

Cap Outer Diameter

(210 °C flat profile) = 0.56 %

(250 °C flat profile) = 0.49 %

INDUSTRY PARTNER TRIALS - PCR CAP MOULDING

Cost Reduction Illustration, per 100 tonne (Based on a potential 10% polymer reduction)



*Figure includes the cost of Broadway's blowing agent additive masterbatch.
**Excludes additional savings potential in production and transport efficiencies.

Our industry partner's projected figures suggest that in just two specific packaging applications, the use of Broadway's blowing agent will deliver cost savings of around £110,000 and a polymer reduction of 105 Tonnes over a five-year period. When combined with the introduction of recycled polypropylene, our partner estimates a carbon saving of 58% associated with these components.



STANDARD
FOAMED
REDUCTION

THE BROADWAY BENEFITS

Broadway's Blowing Agent Masterbatch

- ✓ This is not an imported, traded masterbatch. It was developed in-house by Broadway's technical team.
- ✓ This additive masterbatch is a made to order product. It's manufactured in Holton, Suffolk, offering security of supply.
- ✓ This product utilises an endothermic reaction, which is safer than more widely available exothermic blowing agents.
- ✓ Our product produced the best results in independent trials, against a number of competitor blowing agents.



"Broadway's new blowing agent masterbatch allows our customers to achieve 'more for less.' This product provides a significant weight saving in the final moulded component, meaning less polymer is required.

This offers a double saving as the moulder is able to reduce polymer costs as well as taxation. We're making a sustained effort to expand our product portfolio with new offerings which support customers with their commercial and sustainability goals."

Dr Stephen Rayner
Technical Manager



BROADWAY

YOUR ROAD TO PERFECT POLYMER

25
YEARS
OF QUALITY
MATERIALS

THANK YOU FOR LISTENING

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