CYLATEC

3711 WHIPPLE AVE., N.W.
CANTON, OHIO 44718
TEL: 330-492-2854
FAX: 330-492-3956

CylaCell®

ENDOTHERMIC BLOWING AGENT

A totally new, single component, predictable, environmentally safe blowing agent for thermoset elastomers and polymers that is azide free, eliminating the possibility of nitrosamine formation during vulcanization. It is produced through a unique patented process by Cylatec, Inc. of Canton, Ohio.

DESCRIPTION

Endothermic in nature, CylaCell is supplied as a white, odorless, free-flowing ultrafine powder with unlimited shelf life. It is both fume and odor free, and will not discolor polymers. Unlike azide blowing agents, CylaCell reacts completely at all normal operating temperatures above 300°F without the need for activators, generating approximately 425 cc of blowing vapor per gram of material at 100°C and standard pressure.

APPLICATIONS

Applications include:

- EPDM
- SBR
- Neoprene
- HNBR
- Silicone
- Bulk Molding Compounds

BENEFITS

Commercial applications show that azide blowing agents can be replaced by only one-seventh to one-twentieth as much CylaCell. As a result of its unusual stability, batched compounds have a longer shelf life, and this stability

Perhaps the most significant benefit that CylaCell has to offer to the rubber industry is the effect that it has on finished parts. Tests have shown that CylaCell can increase the useful life of blown compounds by eliminating any potentially reactive blowing agent by-products which can, over time, degrade elastomeric compounds. CylaCell also tends to neutralize normally occurring chemical reactions that can cause deterioration of the elastomer during its lifetime. These benefits are especially evident in parts which are normally subjected to high temperature conditions.

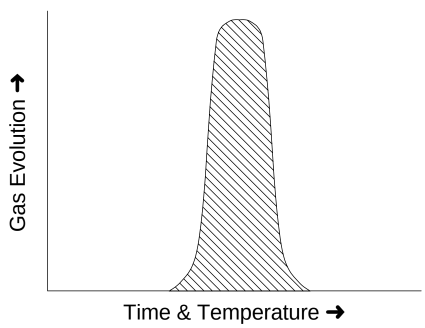
Because CylaCell gases off completely during normal thermal processing, blowing agent accelerators are unnecessary, and post-blow is never a problem. Post heat treatment to insure complete blowing agent activation is not required, saving capital, time and utilities. CylaCell is also totally inorganic and azide free, eliminating the possibility of nitrosamine formation.

THEORETICAL GAS VOLUMES VS. ACTUAL RESULTS

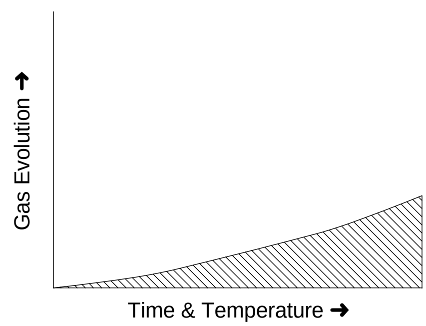
In actual practice, CylaCell is found to be between 7 and 20 times more efficient than typical azide blowing agents. Comparing theoretical gas volumes for these products, however, would lead one to believe that the performance ratio advantage of CylaCell would only be 1.4 to 1, based upon a total theoretical gas evolution of 425 cc/g expressed at 100°C and standard pressure for CylaCell, and 300 cc/g for the azide expressed at the same temperature and pressure. Why, then, is CylaCell so much more efficient in actual practice than the theoretical figures would imply?

The answer, we believe, lies in the gas evolution rates of these products, and the manner in which they evolve the gas. Concept Graph 1 depicts the gas evolution characteristics of CylaCell; Concept Graph 2 depicts the gas evolution characteristics of a typical azide, taking into account its time/temperature decomposition.

Concept Graph 1 - CylaCell

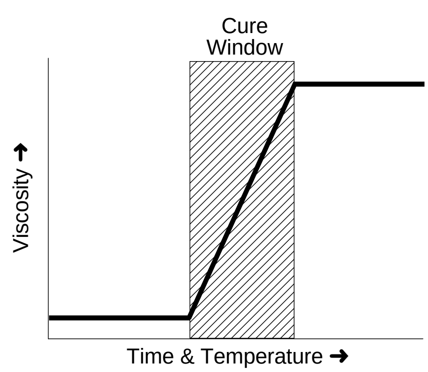


Concept Graph 2 - Azide

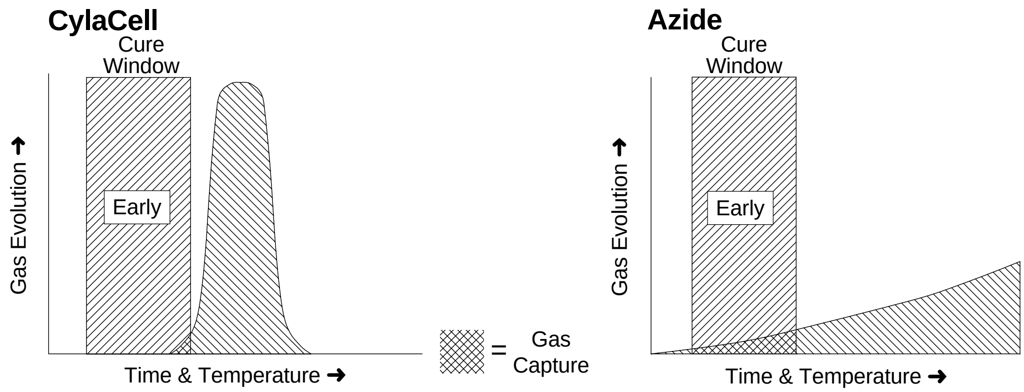


It is obvious from these graphs that the gas evolution rates for these products are quite different in nature, and herein lies the reason for CylaCell's actual performance.

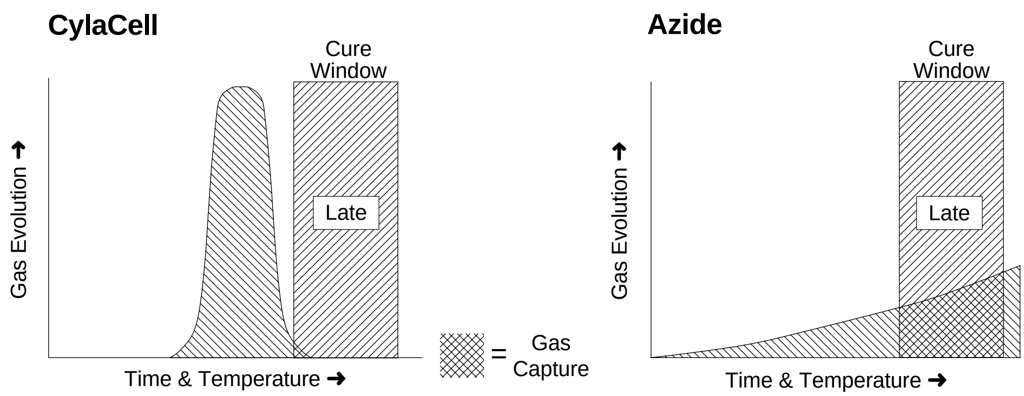
The capture and entrainment of evolved gas in a thermoset compound usually occurs within a specific time and temperature "cure window," which might be described as the period between the beginning of viscosity buildup at the onset of cure and the final set at completion of cure.



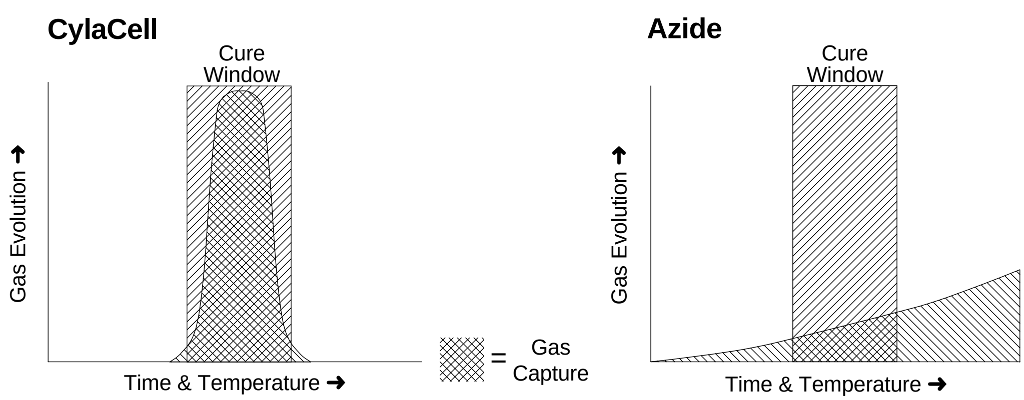
Correct position of the cure window is extremely important when blowing with CylaCell. An early cure window will result in a compound viscosity which is too high for expansion, causing gas blowout.



A late cure window, with subsequent low compound viscosity, will allow gas escape.



By imposing a cure window in the proper position on the above graphs, the efficiency ratio of CylaCell over azide of between 7 and 20 becomes obvious. It is also apparent that no cure window placement takes full advantage of the azide gas.



Thus it can be seen that, with the proper cure, CylaCell offers vast increases in efficiency over azides. Unlike azides, CylaCell reacts completely during cure, eliminating post-blow and the need for post-cure heat treatments.

FORMULATING

A good place to start is to replace azides in a formulation with one-seventh as much CylaCell® and work down from there. Experience has shown that most formulating problems are due to overuse of this highly efficient blowing agent. CylaCell will replace seven to twenty times the amount of azide in most formulations. When using CylaCell, Calcium Oxide must be removed from the formulation.

Mixer and mill temperatures should be kept low, under 220°F if possible, and CylaCell should be added after highest shear mixing. Cure temperatures should be above 300°F. In all likelihood, cure rates will have to be adjusted to take full advantage of CylaCell's high performance. CylaCell is mildly alkaline, and may tend to accelerate cure in some formulations.

When formulating with CylaCell, it is helpful to actually see what is taking place during the blowing/curing operation. In many instances blowing and curing take place out of view, in a mold or heat tunnel. A poor blow may be due to either an early cure window, in which case compound viscosity is too high for expansion and blowout occurs, or to a late cure window, where insufficient viscosity will allow gas escape. In these instances, one visual observation may be worth scores of blind formulation changes. The simplest way to accomplish this visual observation is to subject the compound to the required heat treatment in an open pan in an oven with a window. If a windowed lab oven is not available, a simple toaster oven equipped with a thermocouple and suitable readout device will usually suffice. Setting the oven on high and controlling current with an external thermocouple driven relay controller of the proper capacity will allow for even greater accuracy.

When using this visual method to adjust cure window placement, it is often helpful to watch what happens to a compound without cure, or with a very late or slow cure. By incrementally speeding up the cure (providing earlier cure windows) and observing the results, the correct cure for maximum blow can usually be determined quickly.

Case Study Example: After many unsuccessful attempts by a customer to incorporate CylaCell into a bulk molding compound employing a closed mold, a sample of compound was sent to our laboratory. A quantity of CylaCell equal to one-seventh the amount of azide normally used was added to the compound, and a quantity of this mixture was placed in an open pan in a windowed oven set at the customer’s prescribed temperature. Within a short period of time, the compound began to expand, and continued doing so until the mass had expanded to approximately five times its original size. The mass was then observed to totally collapse to its approximate original volume, and shortly thereafter the compound cured, signaling a late cure window. In subsequent tests, the cure was incrementally adjusted for an earlier cure window until it was observed that cure took place at maximum expansion. In this manner, the correct cure window placement was determined with a minimum amount of time and effort.

CylaCell Advantages

- Environmentally safe
- Equipment friendly
- Extended part life
- Endothermic
- Totally inorganic
- Predictable
- No post-blow
- No discoloration
- Mixes easily
- Corrosion inhibitor
- Non-crystalline
- Unlimited shelf life
- Reacts completely
- Improved cell structure
- Effective nucleating agent
- Noncombustible
- No toxic gases or residues
- Cost Effective

Technical

Composition: Proprietary mixture of Sodium and Magnesium Silicates with Borates, also containing water

Physical Form: Ultrafine powder

Color: White

Odor: None

Organics: None

Gas Evolution: 425cc/g at 100°C, SP

Evolution Temp: 275-325°F

Safety: NFPA Identification System
0=No Hazard, 4=Extreme Hazard

Flammability (RED):	0
Health Hazard (BLUE):	1
Reactivity (YELLOW):	0
Special Hazard (WHITE):	0