



DONGJIN INNOCHEM CO.,LTD.

UNICELL

Foaming Agents
Activators





[Sihwa Plant in Republic of Korea]

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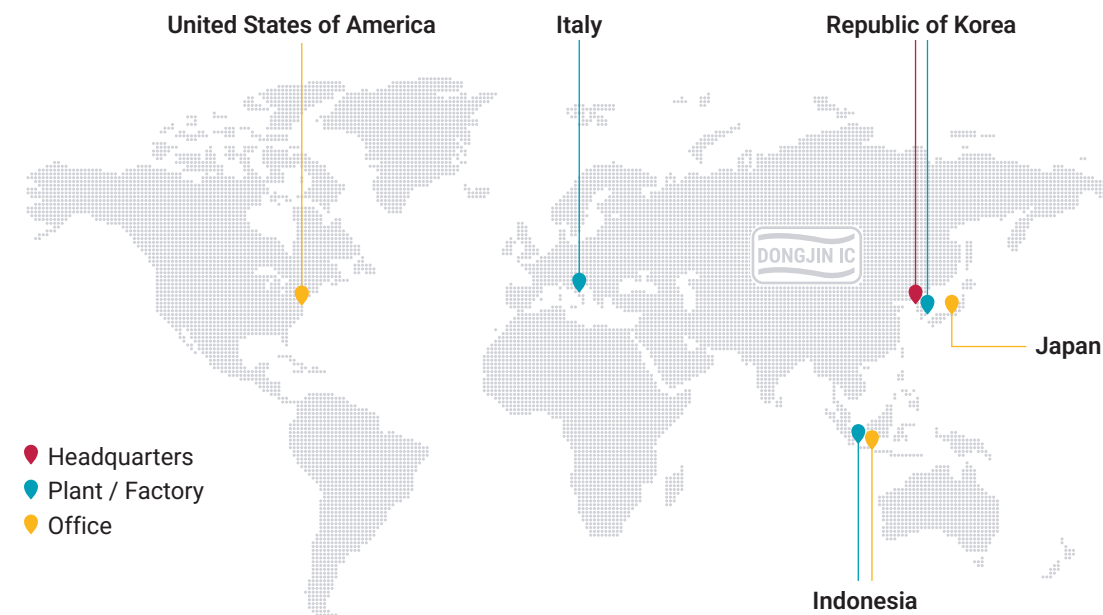
Dongjin Innochem has been manufacturing and supplying foaming agents since 1967 and has become a world-class manufacturer with industry-leading technology through continuous new product development.

UNICELL is the proprietary brand name of Dongjin Innochem’s chemical foaming agents and activators. Recognized for its superior quality in both domestic and global markets, UNICELL holds approximately 30% of the global market share.

We are the only company producing the full range of foaming agents, with an annual production capacity of 80,000 tons. Certified under ISO 9001, ISO 14001, and ISO 45001, we are recognized as an outstanding company for our advanced materials technology, superior foaming agent quality, and strong corporate values. Through continuous and effective product development, we strive to achieve the highest level of customer satisfaction.

Global Operations

Dongjin Innochem develops foaming agents and operates manufacturing facilities and sales organizations at major global hubs, enabling us to respond more rapidly to the needs of local customers.



Company History

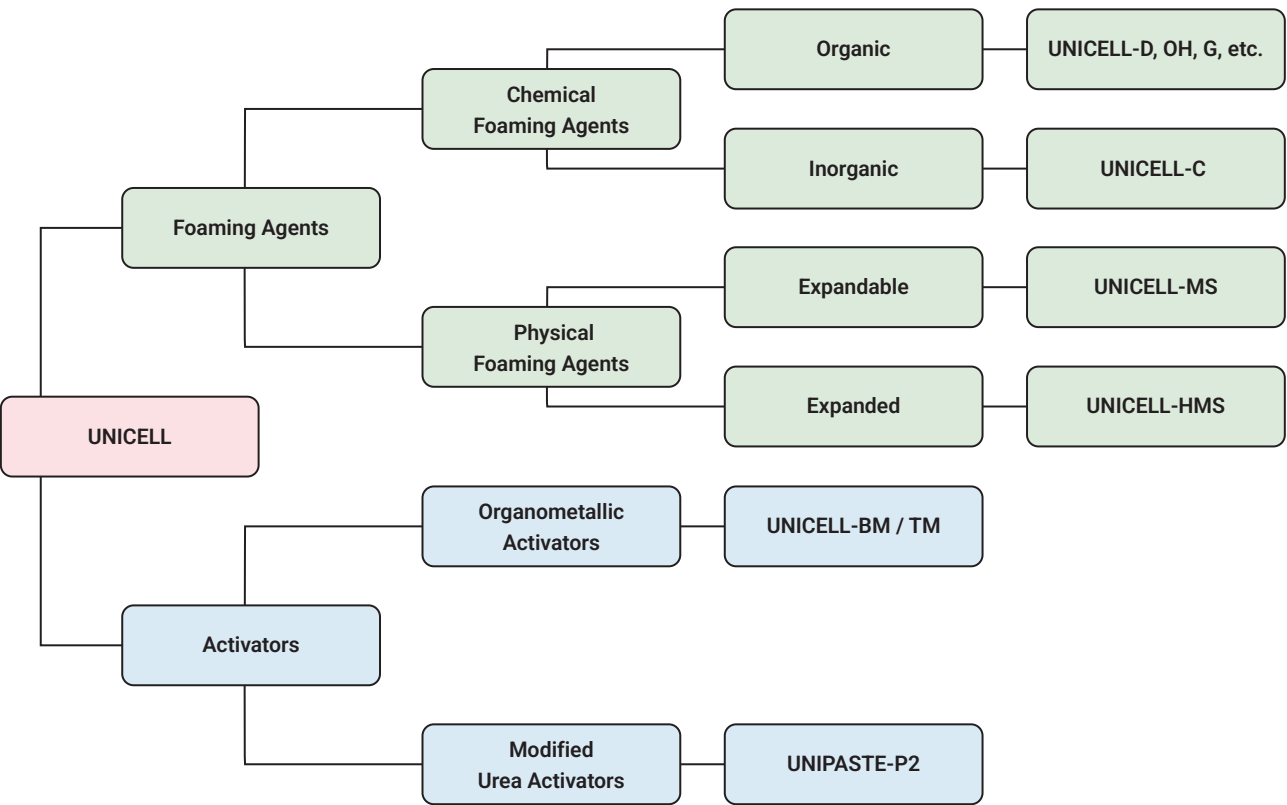


UNICELL is Dongjin Innochem Co, Ltd’s brand name.

It represents high-quality foaming agents and activators designed for the plastics and rubber industries.

Chemical foaming agents generate gases within a polymer melt, forming bubbles that result in a cellular structure through thermal decomposition.

Physical foaming agents generate a cellular structure by undergoing a phase transition.



When customers use UNICELL, they find the following advantages:

- 1. Larger volume and higher yield of evolved gas
- 2. Homogeneous dispersion in plastics and rubbers
- 3. Less contamination
- 4. Good compatibility between decomposition and cross-linking rates
- 5. No adverse effects on the physical and chemical properties of base resins
- 6. Definite and narrow decomposition temperature range
- 7. Easy adjustment of decomposition behavior
- 8. Excellent stability and sufficient shelf life under ordinary storage conditions
- 9. Non-toxic, unobjectionable odor, and relatively harmless to the human body when handled according to the recommendations provided in the MSDS
- 10. Minimal influence of residues on the final product; residues are colorless, non-staining, non-discoloring, and non-flammable

Master List of UNICELL

Trade Name UNICELL	Chemical Name	Appearance	D.T(°C) ⁽⁷⁾	G.V(ml/g) ⁽⁸⁾	Applications
D series	ADCA ⁽¹⁾	Fine Yellow Powder	202~208	225~250	Plastics, Rubbers
XLPE series	Modified ADCA	Fine Yellow Powder	180~210	195~245	Chemical Cross-linked LDPE, PP foam
IXPE series	Modified ADCA	Fine Yellow Powder	200~210	215~250	Electron Beam Radiation Cross-linked LDPE, PP foam
DX series	Modified ADCA	Fine Yellow Powder	150~176	125~190	EVA
DL series	Modified ADCA	Fine Yellow Powder	135~145	135~190	PVC
DK series	Modified ADCA	Fine Yellow Powder	160~168	170~195	EVA, Rubbers
DWP series	Modified ADCA	Fine Yellow Powder	148~179	150~240	PVC Wallpaper
AD series	Modified DNPT	Fine Yellow Powder	132~138	110~130	LDPE, EVA, Rubbers
G series	DNPT ⁽⁵⁾	Fine Lemon- Yellowish Powder	197~208	165~210	Rubbers
OH series	OBSH ⁽²⁾	Fine White Powder	157~163	110~130	Rubbers, PVC, PE
H series	TSH ⁽³⁾	Fine White Powder	143~147	105~115	Rubbers
BSH series	BSH ⁽⁴⁾	Fine White Powder	142~147	85~115	Rubbers
TS	PTSS ⁽⁶⁾	Fine White Powder	228~232	115~155	PVC, HDPE, PP, Nylon
C series	Inorganic Chemicals	Fine White Powder	150~220	110~160	PS, PP, PE, ABS
MS series	Acrylonitrile Copolymer	Fine White Powder	N/A	N/A	Injection (PVC, TPR), coating, and general resins, etc.
HMS series	Acrylonitrile Copolymer	Fine White Powder	N/A	N/A	Super light filler, paint, putty, and coatings, etc.
UNIBEAD series	Cross-linked Polyacrylate	Fine White Powder	N/A	N/A	Film, binder, paint cosmetic filler
UNIPASTE-P2	Urea Based Compound	Fine White Powder	N/A	N/A	Activators for UNICELL-D, G, TS, and OH
BM/TM	Organometalic Compound	Fine White Powder	N/A	N/A	Activators for UNICELL-D
Master Batch Products	Foaming Agent Master Batch	Yellow or White Pellet	N/A	N/A	EVA, SHOES, PS, PP, PE, ABS

(1) ADCA Azodicarbonamide

(2) OBSH *p,p'*-Oxybis (benzenesulfonylhydrazide)

(3) TSH *p*-Toluenesulfonylhydrazide

(4) BSH Benzenesulfonylhydrazide

(5) DNPT Dinitrosopentamethylenetetramine

(6) PTSS *p*-Toluenesulfonylsemicarbazide

(7) D.T. Decomposition temperature

(8) G.V. Gas Volume

Selection Guide of UNICELL

Process Resin	Press Molding	Extrusion	Injection Molding	Calendering	Plastisol Process	Rotational Molding
Rubber	G, H, BSH, DK, AD	D, OH				
EVA	T, D, DX, AD		D, DX			
TPR	T, D, DX, AD		D, AD, MS			
PP		D, TS, C	D, TS			D, TS
PE	D, AD	D, OH, C, TS	D, OH, TS, MS			D, OH
PS		D, C, TS	D, C, TS			D, TS
ABS		D, C, TS	D, C, TS			D
PVC	D, DK	D, C	D, MS	D, T	D, OH, DWP, T, DL, MS, DX	
Polyamide	D	TS	TS			
Acetal		D	D			
Modified PPO		TS	D, TS			
Polyacrylic		D, TS	D, TS			
Fluoroplastics		TS				
Polysulfone		TS	TS			
Epoxy	HMS					
Acryl binder					MS, HMS	



UNICELL-D Series

Description

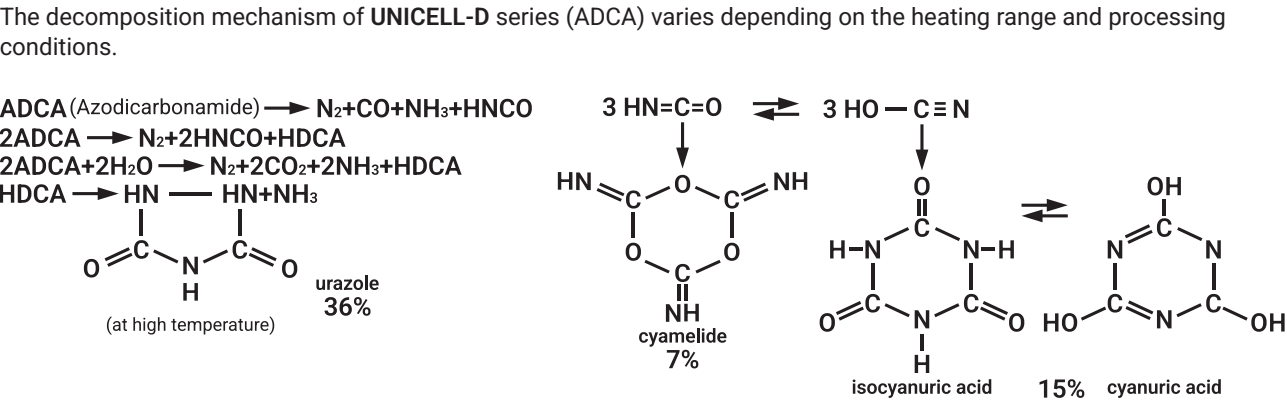
UNICELL-D series is well known as one of the most widely used and effective foaming agents for plastics and rubbers, such as PVC, PP, PE, EVA, ABS, PS, EPDM, SBR, NBR, and TPR.

UNICELL-D series can be tailored to use with rubbers and plastics through the addition of activators.

UNICELL-D has a relatively high decomposition temperature and evolves a large volume of gas.

Therefore, it offers improved safety compared to other colorless foaming agents and produces uniform white microcellular structures.

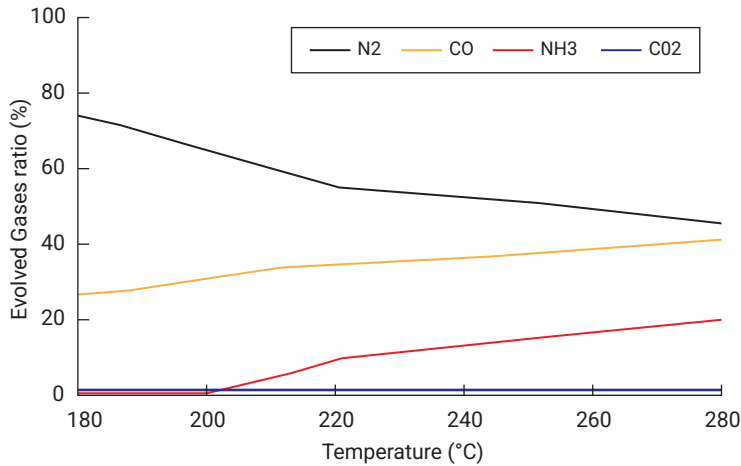
Decomposition of UNICELL-D series



Through these reactions, UNICELL-D series decomposes and generates several types of gases, as follows.

Table 1. The volume ratio of evolved gases depending on temperature and the ratio of gases & residues after decomposition.

Gas		Temp	181~198	210~220	250~280
Evolved gas volume (ml/g)			185~218	263~322	355~454
Residue after decomposition (%)			72.5~76.7	61.3~68.0	46.9~56.5
Gaseous product after decomposition (%)			23.3~27.5	32.0~38.7	43.5~53.1
Evolved Gas	N ₂ (%)		70.8~72.9	53.9~58.8	42.6~48.9
	CO (%)		26.0~26.5	32.9~33.1	36.2~40.8
	NH ₃ (%)		0~0.9	7.4~12.0	8.2~19.1
	CO ₂ (%)		1.0~1.8	0.7~1.2	2.1~2.2



Properties of UNICELL-D series

Table 2. The physical properties of UNICELL-D series.

Item		Specification							
Grade Name		D200A	D300	D400	D600	D800	D900	D1100	D1500
Chemical Name		Azodicarbonamide (Azobisformamide)							
Appearance		Fine Yellow Powder							
Decomposition Temperature (°C)		202~208							
Gas Volume (ml/g)		225~250							
Average Particle Size (μm)	Laser	4.8~5.8	5.6~6.1	6.2~7.2	8.2~9.0	10.8~11.8	12.0~13.0	14.0~15.0	19.0~21.0
	Fisher	2.5~2.8	2.6~2.9	3.6~3.9	5.7~6.1	7.6~8.0	8.0~8.3	9.6~10.0	14.0~17.0
Moisture Content (%)		0.3 max.							
Molecular Weight		116.08							
Specific Gravity (g/cm³ at 25 °C)		1.65							
Specific Heat		0.26							
Decomposition Heat (kcal/mole)		10							
Solubility (g sample/ 100ml solvent)						in water	0.020		
						DMSO	4.300		
						MEK	0.015		
						Acetone	0.016		
						DMF	5.000		
						Toluene	0.012		
						Benzene	0.014		
CAS No.		123 - 77 -3							

Particle size of UNICELL-D series

Particle size is a significant factor in determining the decomposition speed of UNICELL-D series.

As the particle diameter decreases, the surface area increases. Thus, heat transfer to UNICELL-D series is more effective and faster, influencing the decomposition speed of UNICELL-D series.

The particle size is selected to optimize the balance between the curing and decomposition speed of UNICELL-D series.

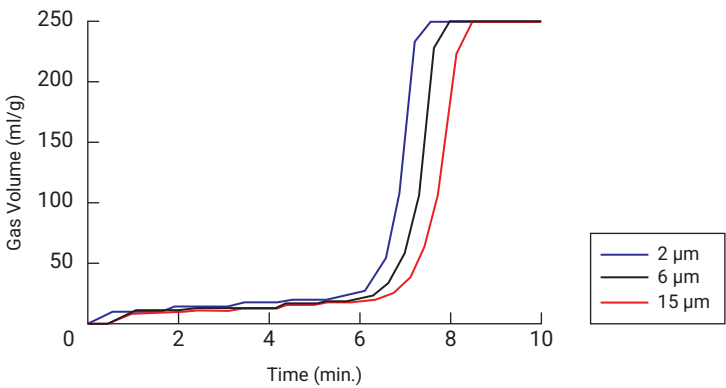


Fig 2. The decomposition behavior of UNICELL-D series at the constant temperature of 200 °C.

Activation (Activator, Kicker)

There are many types of activators for UNICELL-D series, but they must be carefully selected based on factors such as compatibility and the risk of undesirable chemical reactions.

UNICELL-D series offers a wide range of applications due to easy control of the decomposition temperature using its activators.

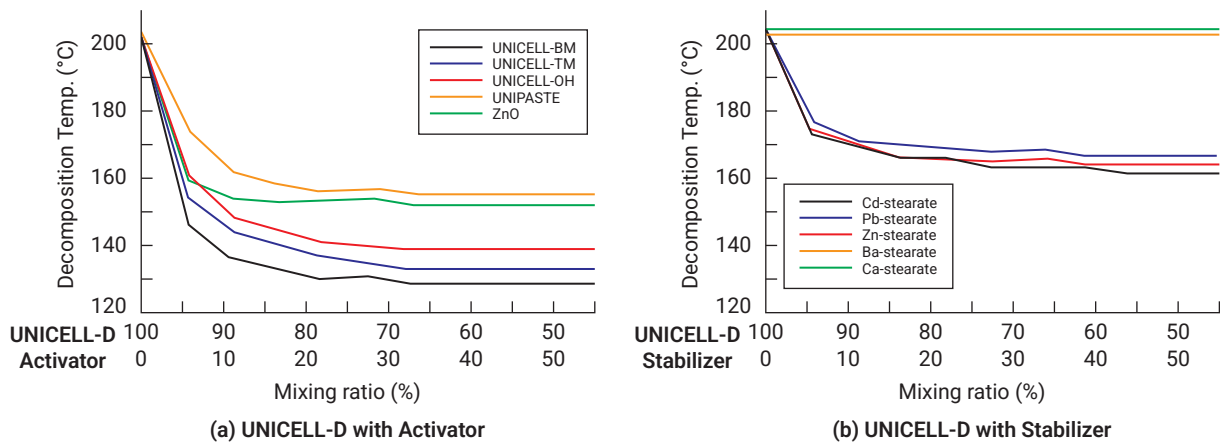


Fig 3. The decomposition temperature of UNICELL-D mixture ; (a) with activators ; (b) with metallic stabilizers

Table 3. The activators for UNICELL-D series and the change of their decomposition temperatures (UNICELL-D : Activator = 1 : 1)

Cadmium Compounds		Strontium naphthenate	153~180	Acetic	140~195
Cadmium oxide	140~184	Strontium zinc laurate	150~180	Citric	145~165
Cadmium perborate	141~165	Magnesium Compounds		Succinic	155~190
Cadmium 2-ethylhexoate	115~160	Magnesium oxide	165~200	Salicylic	165~200
Cadmium acetoacetate	157~205	Lead Compounds		Acetyl salicylic	165~200
Cadmium dodecylmercaptide	130~180	Lead acetate	127~180	Sulfamic	160~205
Zinc Compounds		Lead oxide	151~180	Loralkyl phosphoric	155~195
Zinc chloride	80~135	Lead sulfate	160~185	Maleic anhydride & water	100~180
Zinc acetate	100~105	Dibasic lead phosphite	145~160	Phosphoric	90~160
Zinc nitrate	105~140	Tin Compounds		Butyl phosphoric	130~170
Zinc laurate	150~180	Tin methoxy maleate	140~185	Malic	155~185
Zinc oxide	130~155	Dibutyl tin maleate	150~186	Bases	
Zinc octoate	155~190	Stannous oxide	160~210	Guanidine carbonate	135~180
Zinc carbonate	150~170	Silicon Compounds		Potassium carbonate & water	100~145
Zinc stearate	150~155	Superex clay	140~200	Potassium carbonate anhydrous	155~210
Zinc propionate	158~185	Silene	135~200	Borax	100~185
Zinc dust	155~175	Superfiltrol	120~165	Ethanolamine	85~100
Barium Compounds		Dixie clay	145~200	Miscellaneous	
Barium ricinolate	145~180	Hi Sil	155~201	Dimethyl formamide	135~160
Barium stearate	162~210	Acids		Cupric stearate	145~195
Calcium Compounds		Oxalic	100~150	Aluminium strearate	160~190
Calcium carbonate	155~200	p-Toluene suulfonic	100~180	Titanium oxide	160~195
Calcium stearate	150~175	Glycollic	110~150	Boron triflouride	120~160
Strontium Compounds		Lactic	115~150		

Description

UNICELL-XLPE series, the trade name of modified azodicarbonamide, is specially recommended as an effective foaming agent for cross-linked LDPE or PP foams.

The decomposition residues of UNICELL-XLPE series are non-staining, odorless, and colorless. In addition, they exhibit a micro-cellular structure.

They can be easily dispersed into polyethylene and polypropylene. Moreover, it is unnecessary to add either cross-linking co-agents or foaming activators to produce uniform and fine white foams with smooth surfaces.

UNICELL-XLPE series is stable under normal conditions and throughout compounding. It can be chosen according to processing requirements, without the need for any additives.

Properties of UNICELL-XLPE Series

Chemical Cross-linking Process

Item	Specification				
Grade Name	D1500PE	1500TSK	DT08M	YCE	TL
Chemical Name	Modified Azodicarbonamide				
Appearance	Fine Yellow Powder				
Decomposition Temperature (°C)	181~185	198~202	200~204	195~199	197~203
Gas Volume (ml/g, at 25°C)	200~220	220~240	220~240	195~215	225~245
Average Particle Size (µm)	*11.5~15.5	*11.5~15.5	*14.0~17.0	*11.0~15.0	*17.0~21.0
Moisture Content	0.6 max.	1.3 max.	0.5 max.	1.5 max.	0.8 max.

*Measured by Laser Particle Sizer

Applications

General applications of polyethylene foams with UNICELL-XLPE series include:

- Thermal insulations
- Floating devices
- Packaging materials
- Sports and leisure goods
- Life jackets
- Chemical cross-linking foams

Description

UNICELL-IXPE series, the trade name of modified azodicarbonamide, is specially recommended as an effective foaming agent for cross-linked LDPE or PP foams.

The decomposition residues of UNICELL-IXPE series are non-staining, odorless, and colorless. In addition, they exhibit a micro-cellular structure.

They can be easily dispersed into polyethylene and polypropylene. Moreover, it is unnecessary to add either cross-linking co-agents or foaming activators to produce uniform, fine white foams with smooth surfaces.

UNICELL-IXPE series is stable under normal conditions and throughout compounding. It can be chosen according to processing requirements, without the need for any additives.

Properties of UNICELL-IXPE Series

Electron Beam Radiation Cross-linking Process #1

Item	Specification		
Grade Name	D1000CS	D1500TID	D1500CS
Chemical Name	Modified Azodicarbonamide		
Appearance	Fine Yellow Powder		
Decomposition Temperature (°C)	204~208	202~205	200~202
Gas Volume (ml/g, at 25°C)	225~245	220~240	215~225
Average Particle Size (µm)	*11.0~14.0	*11.5~14.5	*22.0~26.0
Moisture Content (%)	0.08 max.	0.3 max.	0.08 max.

*Measured by Laser Particle Sizer

Electron Beam Radiation Cross-linking Process #2

Item	Specification			
Grade Name	D30CSK	D3000CS	D20PE	D20PEM
Chemical Name	Modified Azodicarbonamide			
Appearance	Fine Yellow Powder			
Decomposition Temperature (°C)	202~208	204~208	204~208	204~208
Gas Volume (ml/g, at 25°C)	225~245	225~245	230~250	230~250
Average Particle Size (µm)	*23.5~27.0	*24.5~26.5	*18.0~24.0	*18.0~24.0
Moisture Content (%)	0.08 max.	0.08 max.	0.3 max.	0.3 max.

*Measured by Laser Particle Sizer

Applications

General applications of polyethylene foams with UNICELL-IXPE series include:

- Thermal insulations
- Floating devices
- Packaging materials
- Sports and leisure goods
- Life jackets
- Electron beam radiation cross-linking foams

Description

UNICELL-DX series is designed for use in cellular injection molding and compression molding.

Each product of the series has unique production properties.

Among these are;

- Plate-out solid decomposition residues are eliminated.
- Mold discoloration is prevented, resulting in stain-free moldings.
- “Built-in nucleation” provides flexibility during processing.
- Physical properties of expanded foam are improved.
(e.g., tensile strength, elongation, tear strength, and compression set)

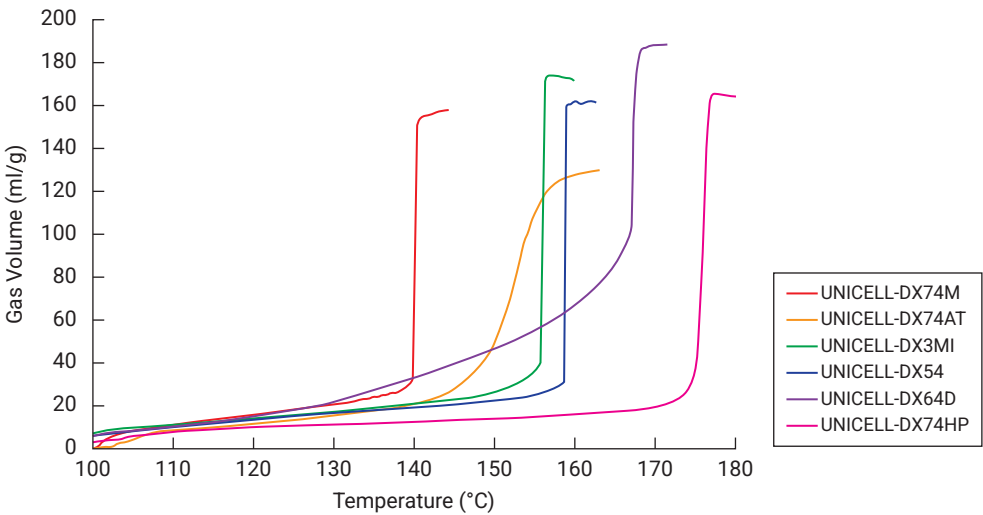
Properties of UNICELL-DX Series

Item	Specification					
Grade Name	DX74AT	DX74M	DX74HP	DX3MI	DX64D	DX54
Chemical Name	Modified Azodicarbonamide					
Appearance	Fine Yellow Powder					
Decomposition Temperature (°C)	150~154	138~141	173~176	152~160	164~168	152~158
Gas Volume (ml/g, at 25°C)	125~135	145~165	162~182	175~185	170~190	150~170
Average Particle Size (µm)	5.0~5.5	*11.5~13.5	6.0~7.0	5.7~6.3	7.5~8.0	7.0~7.5
Moisture Content (%)	0.5 max.	0.5 max.	0.5 max.	0.3 max.	0.5 max.	0.5 max.
Application	EVA Press Molding and Injection					

*Measured by Laser Particle Sizer

Applications

UNICELL-DX series is particularly well suited for shoe sole applications. Each grade is commonly used in EVA and rubber press molding, as well as in PVC extrusion systems.



Description

UNICELL-Master Batch products have been specially developed as a masterbatch of foaming agent for the expansion of EVA/LDPE resin.

UNICELL-Master Batch products consist of EVA/LDPE resin and a foaming agent.

The following advantages are achieved when using UNICELL-Master Batch for the expansion of EVA/LDPE resin.

- Prevents scattering of the foaming agent
- Reduces mixing time with base resin
- Provides excellent storage stability
- Reduces fire and explosion risks
- Prevents deterioration of the physical properties of the foamed part
- Provides whiter and uniform cell structure

Properties of UNICELL-Master Batch Products for EVA

Item	DX74MT	DX74HPMB	D600MT	DX3MT	DX19MT
Appearance	Pale Yellow Pellet	Pale Yellow Pellet	Yellow Pellet	Pale Yellow Pellet	Pale Yellow Pellet
Decomposition Temperature (°C)	143~148	166~172	202~206	155~160	148~154
Gas Volume (ml/g)	75~85	85~95	125~135	95~105	90~100
Contents of Foaming Agent (%)	55	55	50	55	60
VA Contents of EVA (%)	21			22	

Properties of UNICELL-Master Batch Products for LDPE

Item	D800LP65	C#850MT	C#709MT	D1500PEMT	D1500TSKMT
Appearance	Yellow Pellet	White Pellet	White Pellet	Yellow Pellet	Yellow Pellet
Decomposition Temperature (°C)	205~209	150~220	155~165	184~189	201~205
Gas Volume (ml/g)	150~160	35~45	45~50	80~90	85~95
Contents of Foaming Agent (%)	65	33	33	33	33
Carrier Resin	LDPE				

Applications

UNICELL-MT series is designed for general-purpose compression molding of EVA and EVA blends with natural or synthetic rubbers and polyethylene. The series is well suited for the production of shoe soles and phylon sponges.

UNICELL-MT series can be used for producing extrusion and injection molded foams of PS, PP, PE, ABS, TPR, TPE, and other polymers.

Description

UNICELL-DL series is an azodicarbonamide based foaming agent with the fastest decomposition rate, making it suitable for processes such as PVC casting.

UNICELL-DK series is an excellent product with high whiteness, making it suitable for EVA and rubber processes.

Properties of UNIDELL-DL & DK series

Item	Specification				
Grade Name	DL31	DL75N	DL04	DK	DK9
Chemical Name	Modified Azodicarbonamide				
Appearance	Fine Yellow Powder				
Decomposition Temperature (°C)	140~145	142~145	135~140	160~165	163~168
Gas Volume (ml/g, at 25°C)	145~165	170~190	135~155	170~190	175~195
Average Particle Size (µm)	2.6~3.0	3.5~4.0	2.6~3.0	3.0~3.5	3.0~3.5
Moisture Content (%)	0.3 max.	0.3 max.	0.3 max.	0.5 max.	0.5 max.
Application	PVC Plastisol			Rubber Molding	

Applications

When using UNICELL-DL and DK series, process temperatures may need to be lowered to prevent premature decomposition during compounding.

Description

UNICELL-DWP series has been specially designed for use in expanded PVC wall coverings. In addition to the inherent advantages of solid vinyl wall coverings, it provides the following benefits:

- Designed for in-depth applications
- Increases thermal insulation
- Reduces weight, resulting in savings in raw materials
- Produces whiter foams

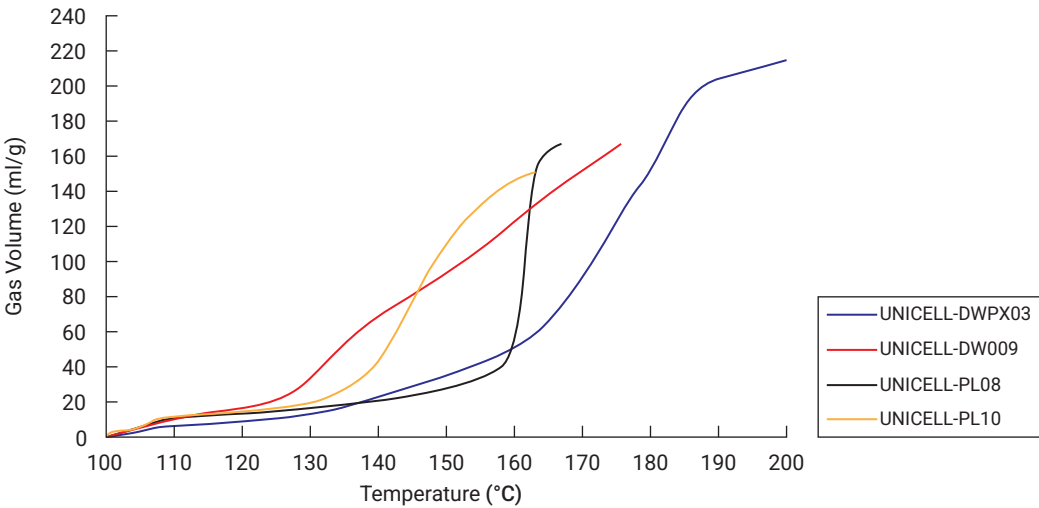
Properties of UNICELL-DWP series

Item	Specification					
Grade Name	DWPX03	PL07	PL08	PL10	DW007	DW009
Chemical Name	Modified Azodicarbonamide					
Appearance	Fine Yellow Powder					
Decomposition Temperature (°C)	176~179	159~165	156~162	148~155	160~165	152~158
Gas Volume (ml/g, at 25°C)	215~240	150~170	155~175	150~170	170~180	155~165
Average Particle Size (µm)	2.8~3.2	2.8~3.2	3.0~3.5	2.3~2.7	2.8~3.2	2.8~3.2
Moisture Content (%)	0.3 max.	0.5 max.	0.5 max.	0.5 max	0.3 max.	0.5 max.
Application	PVC wall coverings					

Applications

UNICELL-DWP series is particularly suitable for PVC wall coverings produced using the spread coating process.

UNICELL-DWP series can be used for mechanical or chemical embossing processes.



Description

UNICELL-AD series is widely used as an economical foaming agent for thermoplastics and rubbers.

UNICELL-AD series is applied in low-temperature processes.

UNICELL-AD series can consistently produce white cellular materials and reduce curing time, thereby saving energy and material costs.

Decomposition of UNICELL-AD series

Item	Specification				
Grade Name	ADST	AD#1	AD#2	AD#3 (AD300)	ADP#3
Chemical Name	Modified N,N'-Dinitrosopentamethylenetetramine				
Appearance	Fine Yellow Powder				
Decomposition Temperature (°C)	132~138	132~138	132~138	132~138	132~138
Gas Volume (ml/g, at 25°C)	120~130	120~130	120~130	115~135	110~120
Average Particle Size (μm)	5.0~6.0	6.0~7.0	5.0~6.0	5.0~6.0	5.0~6.0
Moisture Content (%)	0.5 max.	0.5 max.	0.5 max.	0.5 max.	0.5 max.
Application	Compressing molding of EVA, EVA-PE blending resin, PE and rubbers				

Applications

UNICELL-AD series is widely utilized as a cost-effective foaming agent for thermoplastics and rubber materials.

UNICELL-AD series is suitable for low-temperature processing.

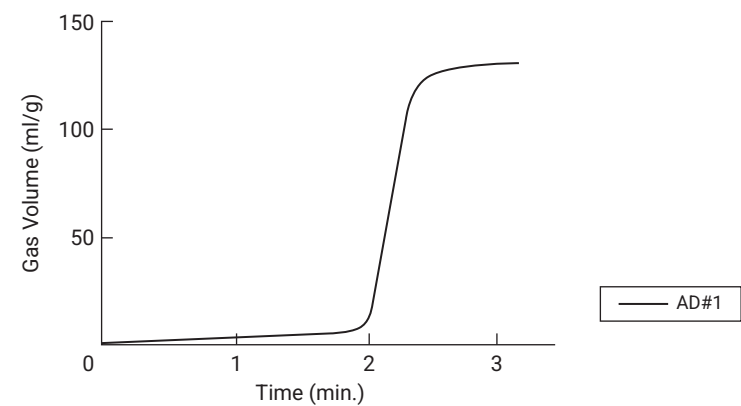


Fig. Decomposition behavior of UNICELL-AD series at the constant temperature of 160°C

Description

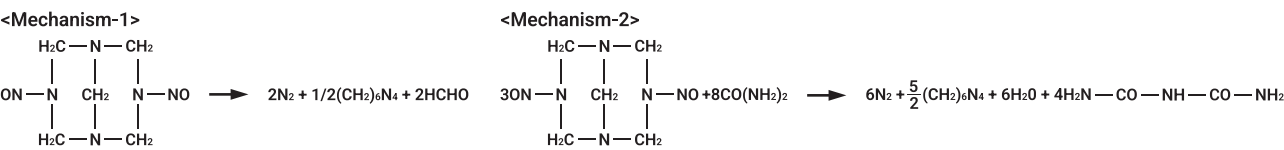
UNICELL-G series, the trade name of dinitrosopentamethylenetetramine, is widely recognized as one of the longest-established and most cost-effective foaming agents for plastics and rubbers, offering non-staining and non-discoloring properties.

UNICELL-G series is usually mixed with oils and inorganic fillers to increase improve thermal stability and minimize handling sensitivity.

Properties of UNICELL-G series

Item	Specification		
Grade Name	G	GP9	GP5
Chemical Name	N,N'- dinitrosopentamethylenetetramine		
Appearance	Fine Lemon Yellow Powder		
Decomposition Temperature (°C)	197~203	197~203	202~208
Gas Volume (ml/g, at 25°C)	200~210	200~210	165~175
Moisture Content (%)	0.5 max.		
Specific Gravity (at 25°C)	1.45		
Decomposition Heat (kcal/mol)	100		
Molecular Weight	186.17		
Solubility (g sample/ 100ml solvent, at 20°C)	Soluble in Water: 0.48 MEK: 1.6 Alcohol: 0.3 Insoluble in almost organic solvents Can be exploded by strong acid, strong base and other oxidizing agent		
CAS No.	101 - 25 - 7		

Decomposition of UNICELL-G series



When UNICELL-G decomposes alone by heat (Mechanism-1), 2 moles of nitrogen gas, 2 moles of formaldehyde, and 0.5 mole of hexamethylene tetramine are produced per mole of UNICELL-G. Formaldehyde and hexamethylene tetramine can cause unpleasant odors in foams. The odor can be partially reduced by adding urea, melamine, or certain amino compounds. Therefore, when UNICELL-G decomposes with the UNIPASTE series (Mechanism-2), the unpleasant odor is reduced. If UNICELL-G comes into contact with strong acids, it decomposes immediately and may cause fire.

The decomposition rate of UNICELL-G series can be increased by adding chemicals such as salicylic acid, phthalic anhydride, and urea-based compounds (UNIPASTE). Among these activators, urea-based compounds are considered the most suitable because they enhance storage stability and are well suited for rubber vulcanization systems.

Applications

UNICELL-G series is one of the most widely used foaming agents in the rubber industry, but it has limitations in plastics due to the highly exothermic decomposition reaction and the unpleasant odor of the residues.

Description

UNICELL-OH series is an outstanding non-staining, non-discoloring nitrogen-releasing foaming agent for the production of both cellular rubbers and plastics. Among the latter, PE, PVC, epoxy, TPR, and phenolic resins are currently expanded on a commercial scale using these foaming agents. It can also be used in the production of thermal insulation materials based on blends of synthetic rubbers and thermoplastics, e.g., NBR-PVC.

UNICELL-OH series produces ammonia-free gas upon thermal decomposition.

The decomposition temperature of UNICELL-OH series aligns with the conventional curing temperature range.

UNICELL-OH series therefore provides good foaming efficiency at conventional curing temperature without the need for activators.

Properties of UNICELL-OH series

Item	Specification					
Grade Name	OH	OH300N	OHW2	OH160NER	OHD3	OHS3
Chemical Name	p,p'- Oxybis (benzenesulfonylhydrazide)					
Appearance	Fine White Powder					
Decomposition Temperature (°C)	157~163	157~163	157~163	157~163	157~163	157~163
Gas Volume (ml/g, at 25°C)	119~129	120~130	115~125	110~120	115~125	115~125
Average Particle Size (µm)	3.2~4.2	2.9~3.3	4.0~4.5	3.2~4.2	*9.0~11.0	*15.0~17.0
Moisture Content (%)	0.5 max.	0.5 max.	0.5 max.	0.5 max.	0.5 max.	0.5 max.
Ash Content (%)	2.0~3.0	2.0~3.0	0.5~1.5	-	2.0~3.0	0.3~0.8
pH	6.0~8.0	6.0~8.0	-	-	-	-
Sieve Test (100 mesh, %)	0.05 max.	0.05 max.	0.05 max.	0.05 max.	0.05 max.	0.05 max.

*Measured by Laser Particle Sizer

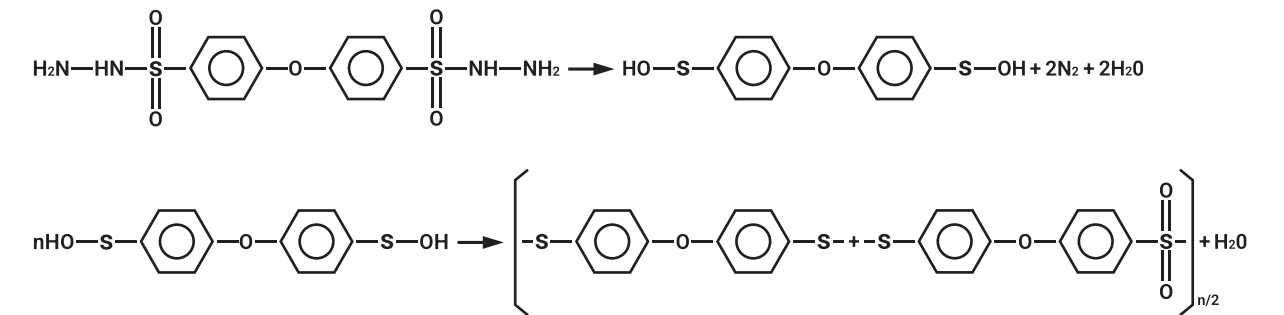
Applications

UNICELL-OH series can be used for foaming PVC, EPDM, EVA, LDPE, CR, and other resins.

UNICELL-OH series is suitable for PVC plastisol and calendaring, as well as extrusion, injection molding, and other thermoplastic processing.

Decomposition of the UNICELL-OH Series

The decomposition of UNICELL-OH series, nitrogen gas is produced as follows:



The solid residue is a non-polar, aromatic, sulfur-containing polymer, which accounts for approximately 84% of the original weight of UNICELL-OH.

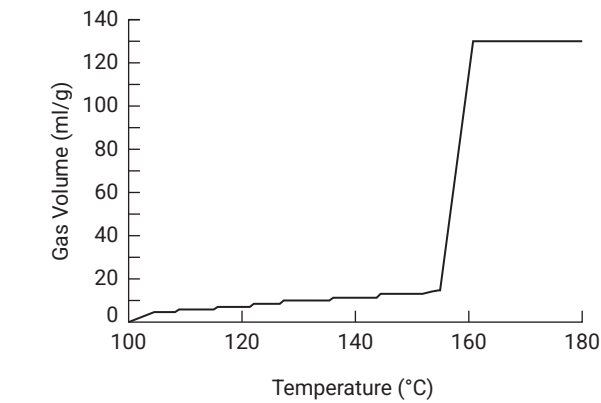


Fig 1. The decomposition behavior of UNICELL-OH when heating speed is 5°C/min.

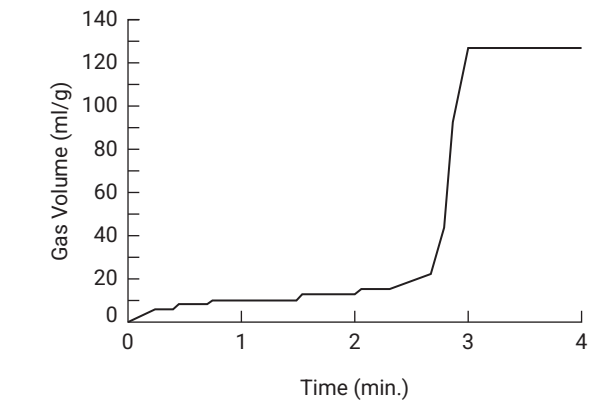


Fig 2. The decomposition behavior of UNICELL-OH at the constant temperature of 160°C.

Activation

The decomposition temperature of UNICELL-OH series can be lowered by various types of activators.

The effect of activation on the decomposition of UNICELL-OH series depends on the type of activator and the processing conditions.

Table 2. The kinds of activators for UNICELL-OH.

Very Strong Activators	UNIPASTE-P2
Strong Activators	DPG (Diphenyl guanidine)
Moderate Activators	Calcium oxide, Calcium stearate, Stearic acid and Vinyl stabilizer (Cd, Pb type)
Weak Activators	Adipic acid, Benzoic acid, Citric acid, Salicylic acid, Lead, and Zinc stearate

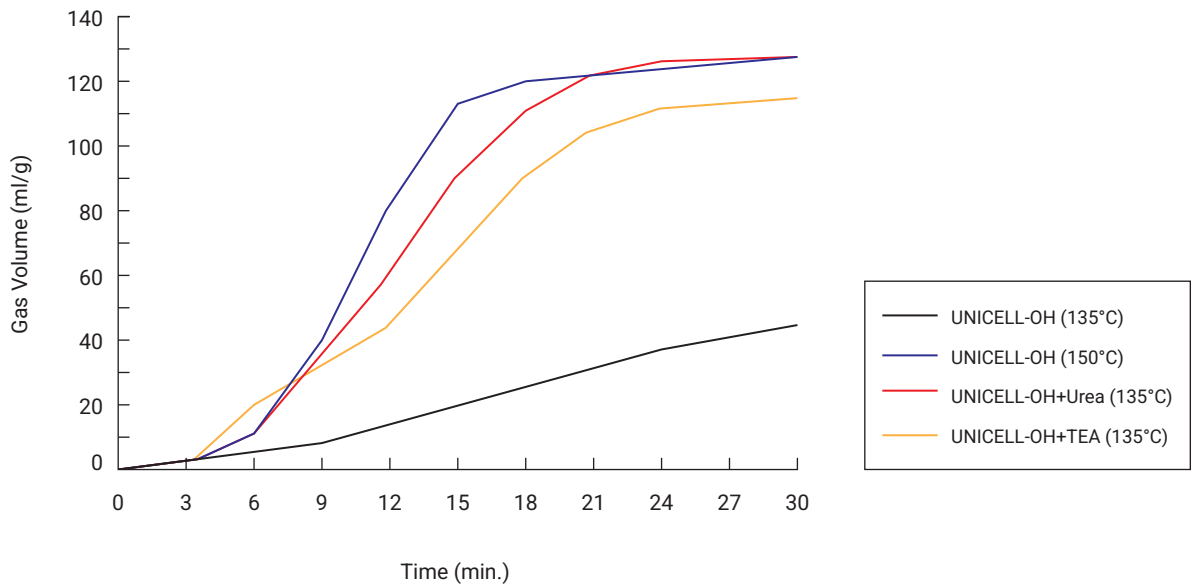


Fig 3. The decomposition behavior of UNICELL-OH at the constant temperature.

Description

UNICELL-H series, the trade name of p-toluenesulfonylhydrazide, produces non-discoloring and low odor cellular foams. UNICELL-H series is designed for regular opened/closed rubber and fine cellular structures. It has excellent performance without activators at conventional curing temperature.

UNICELL-H series is especially recommended for the less shrinkable materials when exposed to light or heat.

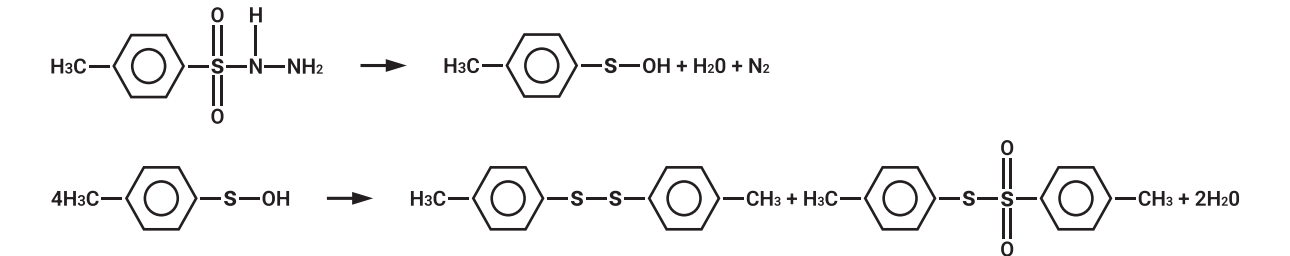
UNICELL-H series also has commercial applications for thermosetting polyesters and PVC sealants.

Properties of UNICELL-H series

Item	Specification
Grade Name	H
Chemical Name	p-Toluenesulfonylhydrazide
Appearance	Fine White Powder
Decomposition Temperature (°C)	143~147
Gas Volume (ml/g, at 25°C)	105~115
Average Particle Size (μm)	5.6~6.0
Moisture Content (%)	0.5 max.
Specific Gravity	1.42
Molecular Weight	186.23
Solubility (g sample/ 100g solvent, at 20°C)	Soluble in Water: 0.49 Toluene: 0.35 Alcohol: 5.1 DMSO: fairly soluble
CAS No.	1576 - 35 - 8

Decomposition of UNICELL-H series

A possible decomposition mechanism of UNICELL-H series has been suggested as follows;



UNICELL-H releases N2, H2O, and p-toluenesulfonic acid as an unstable intermediate when heated. The unstable p-toluene sulfonic acid turns into ditolyl disulfide and tolyl paratoluene thiosulfonate immediately. The sulfur-containing decomposition residues can function as curing agents in rubber compositions.

Applications

The decomposition rate of UNICELL-H series is appropriate for low processing temperatures and does not require decomposition activators. Processing conditions should be carefully adjusted to prevent loss of foaming efficiency. UNICELL-H series significantly activates curing during the foaming process; therefore, the addition of secondary accelerators is generally unnecessary.

Description

UNICELL-BSH series, the trade name of benzenesulfonylhydrazide, can produce cellular foams that are non-discoloring and free of objectionable odors.

UNICELL-BSH series is designed for open or closed cellular rubbers with regular and fine cell structures. It delivers excellent performance without activators at conventional curing temperatures.

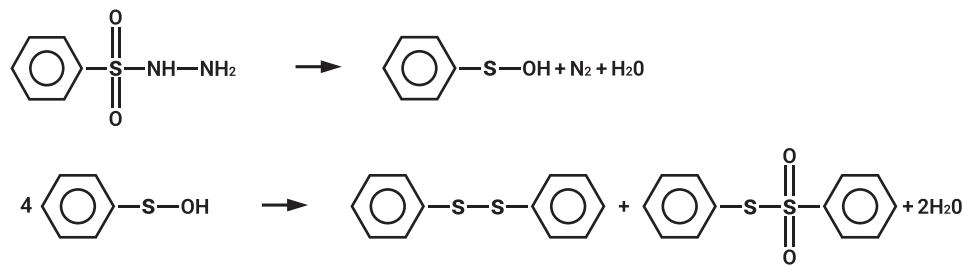
UNICELL-BSH series is especially recommended for materials that shrink when exposed to light or heat.

Properties of UNICELL-BSH series

Item	Specification	
Grade Name	BSH	BSHNE
Chemical Name	Benzenesulfonylhydrazide	
Appearance	Fine White Powder	
Decomposition Temperature (°C)	143~147	142~146
Gas Volume (ml/g, at 25°C)	100~110	98~108
Average Particle Size (μm)	3.0~4.0	3.0~4.0
Moisture Content (%)	0.5 max.	0.5 max.
Specific Gravity	1.48	
Molecular Weight	172.2	
Solubility (g sample/100ml solvent, at 20°C)	Water: 0.49 Toluene: 0.35 Alcohol: 5.10 DMSO: fairly soluble	
CAS No.	80 - 17 - 1	

Decomposition of UNICELL-BSH series

One possible decomposition mechanism of UNICELL-BSH is:



When heated, UNICELL-BSH decomposes into N₂ gas and H₂O, with benzenesulfonic acid formed as an unstable intermediate. The unstable benzenesulfonic acid then immediately converts into dibenzyl disulfide and phenyl benzenethiosulfonate. The sulfur-containing residues can function as curing agents in rubber compositions.

Applications

The decomposition rate of UNICELL-BSH series is suitable for low processing temperatures without the need for decomposition activators.

Careful control of processing conditions is required when using UNICELL-BSH series to avoid reduced foaming efficiency.

During the foaming process, UNICELL-BSH series exhibits significant cure activation; therefore, secondary accelerators are generally not required.

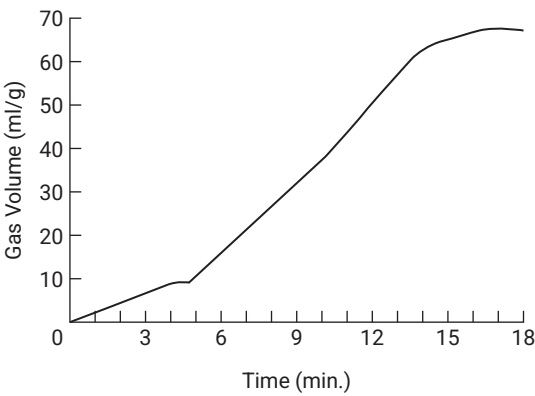


Fig. The decomposition behavior of UNICELL-BSH series at a constant temperature of 150°C.

Description

UNICELL-TS, the trade name of p-toluenesulfonylsemicarbazide, decomposes and evolves gas at a relatively higher temperature than other foaming agents.

The high decomposition temperature of **UNICELL-TS** reduces the risk of premature decomposition during the high-temperature compounding stage.

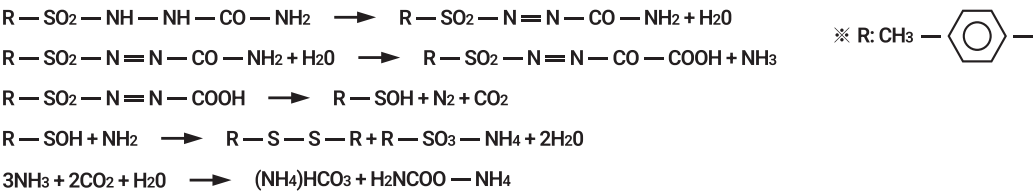
UNICELL-TS is recommended for use in ABS, rigid PVC, polyamide, HDPE, polysulfone, and other polymers that require high processing temperatures.

Properties of UNICELL-TS

Item	Specification
Chemical Name	p-Toluenesulfonylsemicarbazide
Appearance	Fine White Powder
Decomposition Temperature (°C)	228~232
Gas Volume (ml/g, at 25°C)	115~155
Average Particle Size (μm)	4.0~4.6
Moisture Content (%)	0.5 max.
Specific Gravity (at 25°C)	1.44
Molecular Weight	299.25
Solubility (g sample/100ml solvent, at 20°C)	Soluble in Water: 0.49 Toluene: 0.35 Alcohol: 5.10 DMSO: fairly soluble
CAS No.	10396 - 10 - 8

Decomposition of UNICELL-TS

When **UNICELL-TS** decomposes, nitrogen and carbon dioxide are evolved.



Several compounds have been identified as activators for the decomposition of **UNICELL-TS**. Through activation, **UNICELL-TS** becomes applicable to plastics processed at lower temperatures. General activators are; **UNIPASTE** series, zinc oxide, zinc stearate, calcium stearate, lead stearate, and zinc chloride.

Applications

UNICELL-TS exhibits a decomposition rate appropriate for high-temperature processing applications, including ABS, low-melt-index polyolefins, impact-modified polystyrene, and engineering plastics.

UNICELL-TS improves surface appearance in structural foam applications during injection molding and extrusion processes. It allows processing at higher temperatures for resins that can also be foamed using azodicarbonamide, thereby increasing productivity.

The decomposition temperature of **UNICELL-TS** can be lowered through the use of activators.

UNICELL-TS is applicable to white PVC products without requiring high titanium dioxide loadings, which may adversely affect physical properties.

Description

UNICELL-C series, a group of inorganic compounds, is well known as an effective foaming and nucleating agent for plastics including PS, ABS, PE, PP, and modified PPO.

Most foaming agents are exothermic systems that release large amounts of heat during decomposition, resulting in irregular cell structures and localized overheating, particularly in the marginal zones. In contrast, **UNICELL-C** series exhibits endothermic decomposition characteristics.

UNICELL-C series is a white, odorless, non-toxic, free-flowing powder that releases carbon dioxide and water vapor during thermal decomposition. It produces no incrustation on the screw or hopper, allowing the extruder to operate for extended periods before cleaning is required.

Properties of UNICELL-C series

Item	Specification							
Grade Name	C # 850	C # 309	C # 129	C # 709	C # 850MT	C # 709MT	DX820	DX920
Chemical Name	Specially coated Sodium bicarbonate				C# grade Masterbatch		Modified Sodium bicarbonate	
Appearance	Fine White Powder				White Pellet		Pale Yellow Powder	
Decomposition Temperature (°C)	150~220	155~165	155~165	155~165	150~220	155~165	150~180	140~170
Gas Volume (ml/g, at 25°C)	110~130	140~160	140~160	140~160	35~45	45~50	120~160	110~150
Average Particle Size (μm)	5.2~6.2	6.0~7.0	6.0~7.0	6.0~7.0	-	-	-	-
Solubility (g sample/100ml solvent)	Soluble in water and insoluble in organic solvents							

Decomposition of UNICELL-C series

UNICELL-C series decomposes endothermically within a temperature range of 150~220°C. Activators are neither required nor applicable. Decomposition depends solely on heat input and processing conditions, such as friction and pressure. No ammonia odor is generated; only carbon dioxide and water vapor are released, leaving a white decomposition residue.

Applications

UNICELL-C series provides smaller cells with a more uniform distribution (due to its nucleating effect) and a smoother surface (facilitating easy lacquer coating) than azodicarbonamide. It is free from discoloration issues.

UNICELL-C series is suitable for both extrusion and injection molding processes. The recommended dosage is 0.2–1.0% by weight, and a processing temperature of 180–230°C is recommended for practical applications.

UNICELL-C series can also be widely used as a nucleating agent for the direct gas foaming of thermoplastics such as polyolefins, polystyrene, EVA, and PVC using blowing gases such as freon, pentane, butane, nitrogen, and carbon dioxide. It nucleates high-pressure gases into a fine cellular structure in various thermoplastics, including PS, ABS, PE, PP, and modified PPO, during injection molding and extrusion processes.

Table. Selection guide for **UNICELL-C** series

Grade Name	PS	LDPE	HDPE	PP	ABS	PVC
UNICELL- C # 850	○	○	○	○	○	○□
UNICELL- C # 850MT	○	○	○	○	○	○□
UNICELL- C # 309	○□	○□	○□	○	○	○□
UNICELL- C # 129	○□	○□	○□	○	○	○□
UNICELL- C # 709	○□	○□	○□	○	○	□
UNICELL- C # 709MT	○□	○□	○□	○	○	□

○ : as a foaming agent □ : as a nucleating agent

Description

UNIPASTE series consists of highly effective urea-based activators for UNICELL-D, UNICELL-OH, UNICELL-TS, and UNICELL-G. It is used to adjust the decomposition temperature to suit the processing conditions. To prevent moisture absorption and agglomeration, UNIPASTE series is coated with fatty acids or metal soaps.

UNIPASTE series is especially recommended for rubber and plastic foams processed with UNICELL-G, as it reduces the unpleasant odor generated during the thermal decomposition of UNICELL-G.

UNIPASTE series is an essential ingredient for rubber compounds containing UNICELL-G.

Due to its basic characteristics, UNIPASTE series also accelerates the cross-linking (curing) rate, thereby reducing the amount of accelerator required.

All grades of UNIPASTE series are non-staining, non-discoloring, odorless, and completely dispersible in resin matrices.

When used in combination with UNIPASTE series, foaming agents release gases at lower temperatures, reducing energy costs and making them suitable for heat-sensitive substrates or applications where reduction of plasticizer fumes is required.

Moreover, they produce whiter foams than foaming agents. Coatings expanded with foaming agent/ UNIPASTE combinations are free from discoloration and allow a reduction in titanium dioxide content without sacrificing whiteness.

Properties of UNIPASTE series

Item	Specification		
Grade Name	P2	N3M	N3S
Chemical Name	Urea derivatives		
Appearance	Fine White Powder		
Decomposition Temperature (°C)	132~138	132~138	132~138
Gas Volume (ml/g)	120~130	120~130	120~130
Average Particle Size (μm)	4.0~6.0	2.6~3.4	4.0~6.0
Moisture Content (%)	0.3 max.	0.3 max.	0.3 max.

*Decomposition temperature and gas volume are measured when mixed with UNICELL-G in the ratio of 1:1

Decomposition of UNIPASTE series

UNIPASTE series activates UNICELL-D, UNICELL-OH, UNICELL-TS, and UNICELL-G, allowing decomposition at considerably lower temperatures. The decomposition temperature decreases gradually as the amount of UNIPASTE increases, and the activation effect is stronger for UNICELL-G than for UNICELL-D, UNICELL-OH, and UNICELL-TS.

When used in combination with UNICELL-G, the UNIPASTE series reduces the formaldehyde released from UNICELL-G, which otherwise causes an unpleasant odor in foams expanded with UNICELL-G alone.

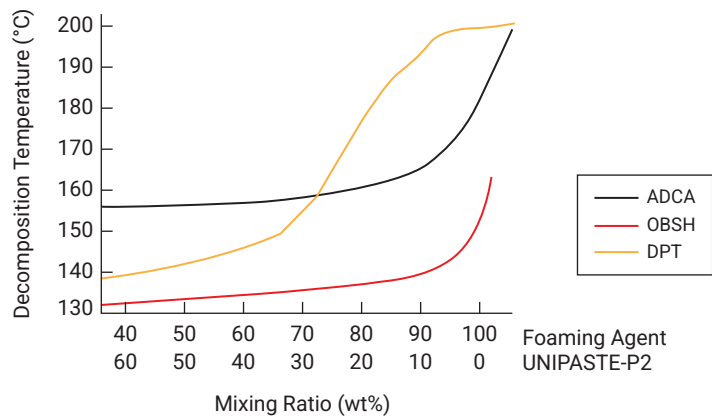


Fig. The activation effects of UNIPASTE-P2 and UNICELL-D, UNICELL-G, and UNICELL-OH

Description

UNICELL-BM/TM are very strong organometallic activators for UNICELL-D. They adjust the decomposition temperature to make it suitable for the process.

In combination with UNICELL-BM/TM, foaming agents release gases at lower temperatures, thereby reducing energy consumption. They are especially suitable for thermo-sensitive substrates or applications requiring reduced plasticizer fumes. In addition, they produce whiter foams compared with foaming agents.

Coatings expanded with UNICELL-BM/TM combinations are free from discoloration and enable a reduction in the quantity of titanium dioxide without sacrificing whiteness.

Properties of UNICELL-BM/TM

Item	Specification	
Grade Name	BM	TM
Chemical Name	Zinc benzenesulfinate	Zinc ditoluenesulfinate
Appearance	Fine White Powder	
Average Particle Size (μm)	2.0~4.0	2.0~4.0
Moisture Content (%)	5.0 max.	5.0 max.
Sieve Test (on 100 mesh)	nil	nil
Melting Point (°C)	218~228	255~265
Molecular Weight	347.63	375.65
CAS No.	24308 - 84 - 7	24345 - 02 - 6

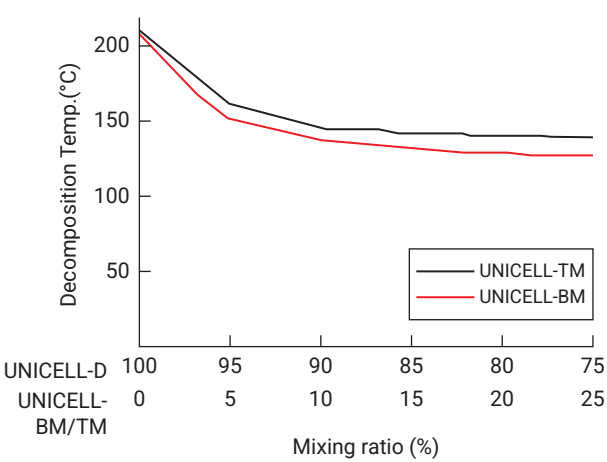


Fig 1. The decomposition temperature of UNICELL-D mixture with UNICELL-BM/TM

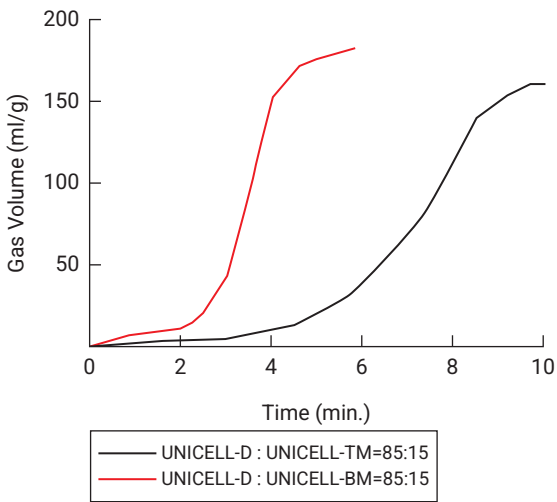


Fig 2. The decomposition behavior of UNICELL-D of the constant temperature of 160°C (mixing ratio. UNICELL-D : UNICELL-BM/TM=85 : 15)

Description

The combination of **UNICELL-D600LF** (foaming agent) and **UNICELL-LFP** (promoter) reduces formamide emissions to below 100 ppm. **UNICELL-LFP** shows optimal effectiveness when used together with **UNICELL-D600LF**.

Promoter **UNICELL-SLFP** is compatible with **UNICELL** foaming agents and other conventional ADCA foaming agents. It effectively reduces the formamide content to below 100 ppm.

For footwear applications, the combination of **UNICELL-EF115** (foaming agent) and **UNICELL-EFP1** (promoter) can reduce formamide emissions to below 100 ppm. **UNICELL-EFP1** is a promoter that enhances mechanical properties when used in combination with **UNICELL-EF115**.

UNICELL-DX19MT can reduce ammonia emissions by more than 80% compared with conventional foaming agents used for shoe soles. The evolved ammonia gas concentration is less than 20 ppm.

Properties of ECO-Friendly Foaming Agents

Low Formamide Foaming Agents & Promoter

Item	Specification			
	Combination of Foaming Agent and Promoter			
	D600LF	LFP		
Appearance	Yellow Powder	White Powder		
Average Particle Size (µm)	5.7~6.1	4.0~7.0		
Moisture Content (%)	0.5 max.	0.5 max		
Decomposition Temperature (°C)	196~202	164~168*		
Evolved Gas Volume (ml/g)	180~200	150~170*		
Formamide Content Analysis Result	Foaming Agent	D600	D600LF	D600LF & LFP
	Formamide (ppm)	1,200~1,500	<300	<100

*The decomposition temperature and gas volume were measured using a mixture of **UNICELL-D600LF** and **UNICELL-LFP** at a ratio of 5.0:2.0.

◆ EVA is foamed by a compression molding process.

Low Formamide Promoter (master batch type)

Item	Specification		
	SLFP		
Appearance	Light Blue Pellet		
Decomposition Temperature (°C)	174~178*		
Evolved Gas Volume (ml/g)	100~120*		
Contents of Promoter (%)	60		
Carrier Resin	EVA (VA contents 22%)		
Formamide Content Analysis Result	Foaming Agent	D600	D600 & SLFP
	Formamide (ppm)	1,200~1,500	<100

*The decomposition temperature and gas volume were measured using a mixture of **UNICELL-D600MT** (or general ADCA) and **UNICELL-SLFP** at a ratio of 5.0:2.0.

◆ EVA is foamed by a compression molding process.

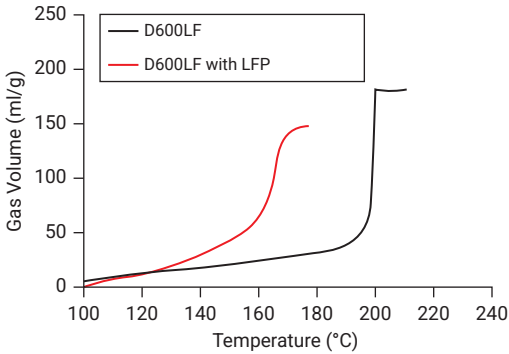


Fig 1. The decomposition temperature of **UNICELL-D600LF** and **UNICELL-D600LF** with **UNICELL-LFP**.

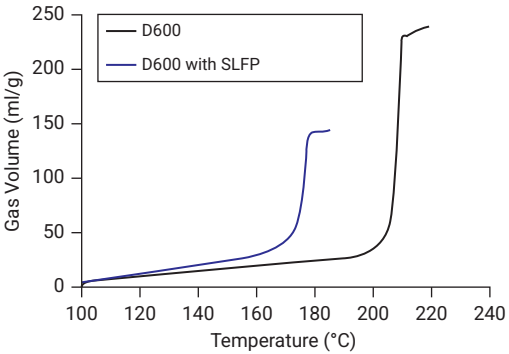


Fig 2. The decomposition temperature of **UNICELL-D600** and **UNICELL-D600** with **UNICELL-SLFP**.

UNICELL-ECO Friendly Foaming Agents

Low Formamide, Low Ammonia Foaming Agents & Promoter (master batch type)

Item	Combination of Foaming Agent and Promoter		
	EF115	EFP1	
Appearance	Yellow Pellet	Light Blue Pellet	
Decomposition Temperature (°C)	156~160*		
Evolved Gas Volume (ml/g)	80~100*		
Contents of Promoter (%)	60		
Carrier Resin	EVA (VA contents 22%)		
Gas Content Analysis Result	Foaming Agent	Normal ADCA	EF115 with EFP1
	Formamide (ppm)	>800	<100
	Ammonia (ppm)	>500	<30

*The decomposition temperature and gas volume were measured using a mixture of UNICELL-EF115 and UNICELL-EFP1 at a ratio of 5.0:2.0.

◆ EVA (slab) is foamed by an injection molding process.

Low Ammonia Foaming Agents

Item	Specification
	DX19MT
Appearance	Pale Yellow Pellet
Decomposition Temperature (°C)	148~154
Evolved Gas Volume (ml/g)	90~100
Contents of Promoter (%)	60
Carrier Resin	EVA (VA contents 22%)
Gas Content Analysis Result	EVA foam using UNICELL-DX3MT : 200ppm EVA foam using UNICELL-DX19MT : 20 ppm under *Remarks : when ZnO is additionally used, ammonia evolution may increase

Applications

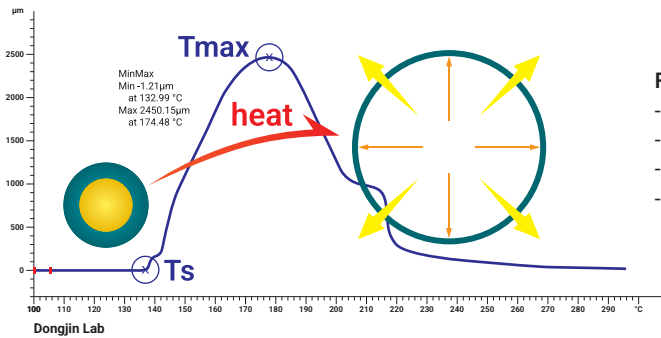
UNICELL-LFP and UNICELL-SLFP are suitable for general-purpose compression molding. UNICELL-EF115, in combination with UNICELL-EFP1 and UNICELL-DX19MT are recommended for injection phylon processing of EVA or EVA blended with natural or synthetic rubbers, especially for fitness and children's mats, shoe soles, and phylon sponges, providing enhanced safety by reducing hazardous gases such as formamide and ammonia.



Description

UNICELL-MS series are thermally expandable micro-spheres. They are an unexpanded type consisting of a polymeric shell and a volatile core, with particle sizes ranging from 10 to 100 µm and densities ranging from 1.05 to 1.20 g/cc.

Structure and Expansion Mechanism



- Features:
- Excellent expandability and thermal stability
 - Excellent solvent resistance
 - A wide range of grades
 - Suitability for customer requirements

When UNICELL-MS is heated to the Tg of its shell, it begins to expand dramatically. This point is referred to as Ts. With further heating, it expands volumetrically by approximately 40–50 times. As the shell becomes critically thin, a hollow sphere is formed. This point is referred to as Tmax. If heated above Tmax for an extended period, the particles may shrink or collapse.

Products

Dry type

Item	Specification			Application
	APS (µm)	Ts(°C)	Tmax(°C)	No.
MS140DS/D	15±5 / 25±5	90±5	120±5	1
MS145DS/D	12.5±3.5 / 20±4	100±5	140±5	1
MS2002	25±10	115±5	168±5	2
MS4004A	20±3	122.5±7.5	167.5±7.5	1,5
MS4600FSS	7.5±2.5	138±5	160±5	4,7
MS4600FS	14.5±3.5	130±5	170±5	2,4
MS4600X	22±4	125±5	170±5	5
MS4002	13.5±3.5	130±5	173±5	2,4
MS4002A	20±3	122.5±7.5	180±5	2,4
MS4600	25±5	122.5±7.5	175±5	5
MS4600F	37±5	120±5	180±5	3,5
MS4703F	32±5	120±5	183±5	2
MS4801F	33±5	123±5	183±5	3
MS198D	25±5	165±5	200±5	3
MS197D	24±4	169±3	193±3	3
MS200	30±4	140±5	200±5	3
MS3001	34±6	161±5	214±6	7

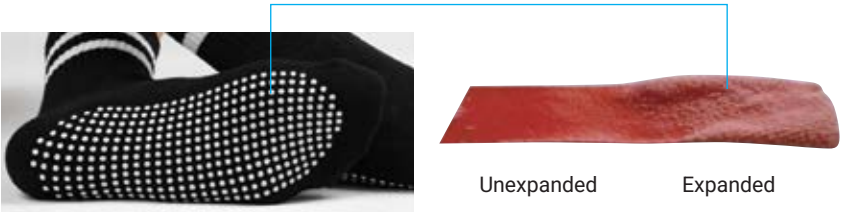
*APS (Average Particle Size) can be selectable

Wet type

Item	Specification				Application
	APS (µm)	Ts(°C)	Tmax(°C)	Moisture(%)	No.
MS140WS/W	15±5 / 25±5	90±5	120±5	20±1	1
MS145WS/W	12.5±3.5 / 20±4	100±5	140±5	20±1	1
MS3000A	53±4	190±7	210±5	20±1	6

Applications

1. Acryl Binder for Textile



2. PVC Wallpapers

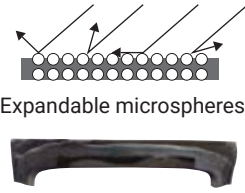
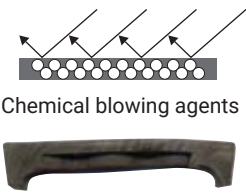


3. Shoe-sole of PVC, TPR, EVA

4. Artificial Leather with PU Coating

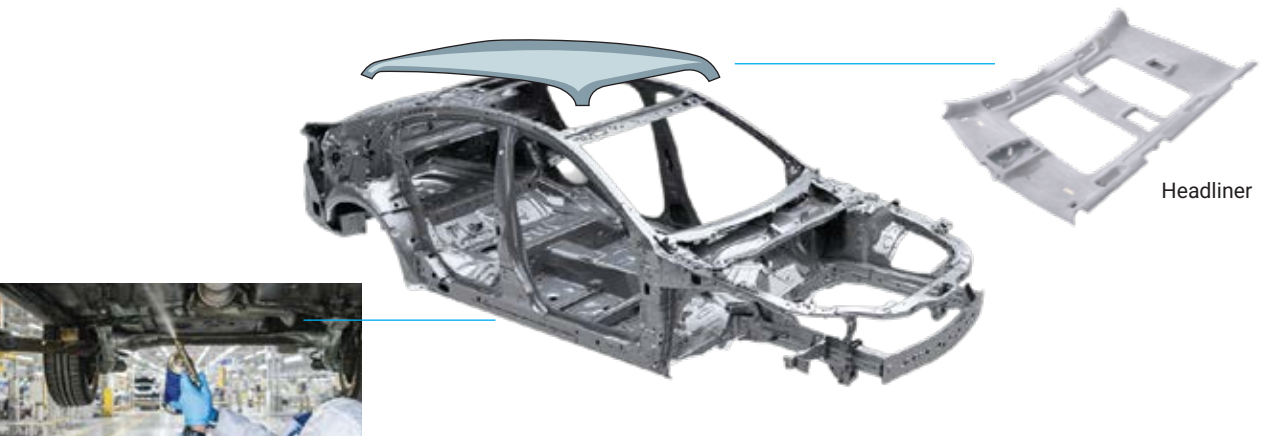
Key Characteristics of UNICELL-MS:

- Reduced weight
- Elegant matte surface
- Fine isolated cell structure
- Superior shape stability
- Good resilience



5. Underbody Coatings

6. PP/GF Reinforcement Materials

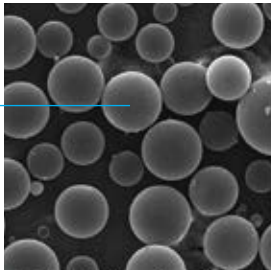
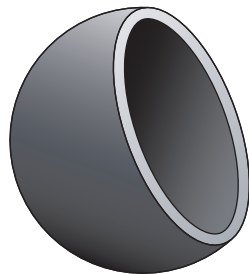


7. Others: Mat, Floorings, Cushion Tape ETC.

Description

UNICELL-HMS are hollow expanded microspheres.
They are an expanded type of UNICELL-MS and can be used as ultralight fillers.

Structure



- Features:**
- Extremely low density, 0.017~0.165g/cm³
 - Excellent elasticity
 - Excellent solvent resistance
 - Excellent sandability

Products

Dry Type

Item	APS (μm)	Density (kg/m³)
HMS A grade	Softening point: 120°C	
A20D	15.0~35.0	45 ± 5
A50DT	38.0~58.0	25 ± 5
A100D	65.0~150.0	22.5 ± 4.5
HMS C grade	Coated hollow microsphere	
C20D	15.0~35.0	150 ± 15
C50D	35.0~55.0	120 ± 15
C100D	80.0~150.0	90 ± 15

Wet Type

Item	APS (μm)	Density (kg/m³)	Moisture (%)
A20W	15.0~35.0	45 ± 5	85 ± 2
A50W	38.0~58.0	25 ± 5	85 ± 2
A100W	65.0~150.0	22.5 ± 4.5	85 ± 2

Applications

Toy Clay



Leather Filler for Cracks & Holes



Insulation Paint



Car Repairing



Art Walls



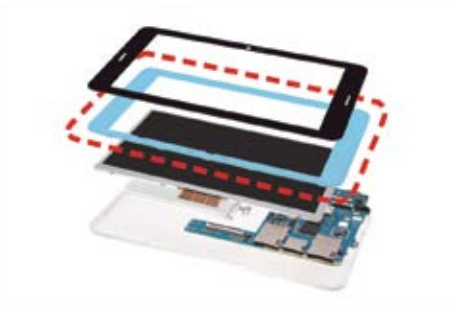
Ceramics



Sensitizer of Emulsion Explosives



Window Cushion Tape



UNIBEAD Series

Description

UNIBEAD series consists of fine, spherical polymeric beads composed of cross-linked polymethyl methacrylate (PMMA) and polybutyl methacrylate (PBMA).

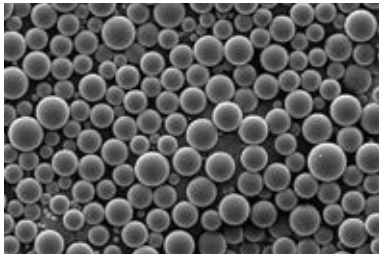
When incorporated into resins, UNIBEAD diffuses light, imparting a diffusion effect to sheets or films.

In inks or paints, UNIBEAD provides anti-scratch and matting effects.

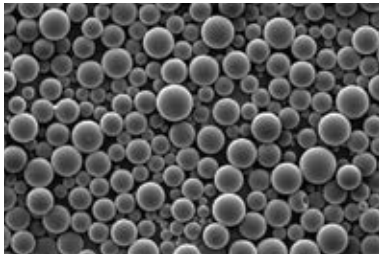
When used in cosmetic products such as emulsion lotions, UNIBEAD provides a soft, wrinkle-free feel..

Products

Grade	Particle Size (μm) Mean Diameters: D50	Heat / Solvent Resistance	Refractive Index	Particle Distribution
DBPH	7/15/20/25	High	1.49	Poly dispersion
DBPB	7/15/20/25	High	1.49	Poly dispersion



UNIBEAD-DBPH



UNIBEAD-DBPB

Applications

Display: -Diffusion film
-Anti-glare film



Lighting: -LED light cover



Paint / Ink: -Anti-scratch material
-Anti-gloss material



Cosmetics: -Soft focus
-Oil absorbency



PVC Wall Covering (1)	
PVC resin (p=1000)	100
Filler	100
Plasticizer	80
Stabilizer (Ba-Zn)	3
Process Oil	7
UNICELL-OH	4

Gelling Condition 145°C x 50sec.
Foaming Condition 260°C x 15sec.
Thickness of Sheet 0.2mm

PVC Wall Covering (2)	
PVC resin (p=1000)	100
Filler	30~40
Plasticizer	50
Stabilizer (Ba-Zn)	3
TCP	30
Sb2O2	10~20
TiO2	10
ZnO	1~2
UNICELL-DWPX03	3

Gelling Condition 150°C x 50sec.
Foaming Condition 230°C x (30~60)sec.
Thickness of Sheet 0.2mm

PVC Flooring Material (1)	
Foam Layer	
PVC resin (p=1300)	50
PVC resin (p=800)	50
Filler	20
Plasticizer	70
Stabilizer (Ba-Zn)	3
TiO2	3
ZnO	1
UNICELL-D200A	3.4 / 2~2.5

Skin Layer	
PVC resin (p=1700)	100
Plasticizer	55
Stabilizer (Ba-Zn)	3

Foam Layer Gelling Condition (150~160°C) x 30sec.
Skin Layer Gelling Condition (150~160°C) x 50sec.
Foaming Condition 210°C x 80sec.

PVC Flooring Material (2)	
Foam Layer	
PVC resin (p=1000)	100
Filler	20
Plasticizer	60~70
Stabilizer (Ba-Zn)	1.5
Dispersant	0.2
TiO2	3
ZnO	1.6
UNICELL-D300L	2.5

Skin Layer	
PVC resin (p=1700)	100
PVC resin (p=1000)	35
Plasticizer	60~65
Stabilizer (Ba-Zn)	2.5
UV absorption	0.3

Foam Layer Gelling Condition (150~160°C) x 30sec.
Skin Layer Gelling Condition (150~160°C) x 50sec.
Foaming Condition 200°C x 90sec
Foam Layer Thickness 0.3mm
Skin Layer Thickness 0.2mm

PVC Flooring Material (3)	
PVC	100
Plasticizer	60
Stabilizer (Ba-Zn)	3
CaCO3	50
UNICELL-DL31	4

PVC Artificial Leather (1) : no-embossing	
PVC resin (p=1700)	64
PVC resin (p=1100)	16
PVC blend resin (C-65V)	20
Filler	20
Plasticizer	50~65
TXIB	5
Stabilizer (Ba-Zn)	5
Pigment	3~5
UNICELL-D1100	3.5

Gelling Condition 160°C
Foaming Condition 250°C
Thickness of Sheet 0.12~0.2mm

PVC Artificial Leather (2) : embossing	
PVC resin (p=1700)	80
PVC blend resin (C-65V)	20
Filler	20
Plasticizer	60~80
TXIB	3
Stabilizer (Ba-Zn)	3
Pigment	3~5
ESO	5
UNICELL-DX77N	3.5~4.5

Gelling Condition 150°C
Foaming Condition 240°C
Thickness of Sheet 0.14~0.4mm

PVC Wall Covering



PVC Flooring Material



PVC Artificial Leather



PVC Artificial Leather



PVC Artificial Leather (1)	
PVC resin (suspension, p=1000)	100
Filler	10
Plasticizer	60
Stabilizer (Ba-Zn)	3
Stearic Acid	0.5
UNICELL-D900	4.5

Calendering Condition 155~165℃
Foaming Condition 200~230℃, 1~3 min.

PVC Artificial Leather (2)			
Ingredient \ Usage	Artificial Leather		Car Mat
	For Clothing	For Packaging	
PVC resin (suspension, p=1100)	100	100	100
Plasticizer I	90	50	50
Plasticizer II	15	10	5
Plasticizer III	10	0	0
ESO	5	5	0
Stabilizer (Ba-Zn)	2.5	2.5	2.5
CaCO ₃	5	20	10
UNICELL-D600/D900/D1100	4	3	5

Compounding Condition 140~155℃
Calendering Condition 155~165℃
Foaming Condition 200~230℃, 1~3 min.

PVC Artificial Leather



PVC Artificial Leather



PVC Artificial Leather



PVC Artificial Leather



PVC Injection Mold Foam (1) : Sandal	
PVC resin (p=1000)	90~95
EVA resin NBR (A.N. 41%) ABS (hi-flow)	5~10
Plasticizer	30~40
Stabilizer	3
UNICELL-D300L	2.5

Barrel Temperature C1: 140℃
C2: 170℃
C3: 170℃
Mold Temperature 30~40℃

PS, ABS/PS Injection Mold Foam	
PS, ABS/PS	100
UNICELL-D1100/C#850	2~3 / 1~2

Process Temperature 200~240℃

PVC Injection Mold Foam



PVC Injection Mold Foam (2) : Sandal	
PVC resin	100
Filler	as required
Plasticizer	60~70
Stabilizer	3~4
UNICELL-D300L	2~3

Barrel Temperature 165℃~190℃
Mold Temperature 30℃~40℃

PP,ABS,HDPE,HIPS Injection Mold Foam	
PP / ABS / HDPE / HIPS	100
UNICELL-D1100/C#850	2~3 / 1~2

Compounding 15~20 min. in dry tumble
Barrel Temperature back 193~199℃
mid 199~204℃
front 210~221℃
Nozzle Temperature 218~227℃
Mold Temperature 16~38℃

EVA Injection Mold Foam



PVC & NBR Press Mold Foam (1)	
PVC resin (p=1000)	90
NBR	10
Filler	7
Plasticizer	60~65
Ba-Stearate	5
Ca-Stearate	5
ZnO	2
Stearic Acid	1
DCP	0.5~0.7
UNICELL-DK9	10~20

Roll Temperature 140℃
Foaming Condition 160℃ x 150kg/cm² x 15min.

PVC Press Mold Foam (3) : with Plastisol	
PVC resin (emulsion, p=1000)	100
Plasticizer	70
Ba-Stearate	2
Ca-Stearate	3
UNICELL-D600	7

1st Heating 172℃ x 10~20min.
Cooling Condition 25℃ x 5~20min.

EVA Shoe Sole (1)	
EVA (VA 25%)	10
EVA (VA 15%)	90
Stearic Acid	1
Filler	5
DCP	0.7
Fluorescent	0.06
TiO2	3
UNICELL-DX74M	9

Roll Temperature 90℃~100℃
Press Condition 160℃ x 35min.
Mold Depth 22mm

PVC Press Mold Foam (2)	
PVC resin (p=1000)	100
Filler	20~30
Plasticizer	50~60
Ba-Stearate	2
Ca-Stearate	2
DCP	0.5
UNICELL-DK	20

Roll Temperature
Roll Time
Foaming Agent Mixing
DCP Mixing Time
Sheet Thickness
Cooling Temperature
Press Condition

PE Block Foam	
LDPE	100
ZnO	0.4
DCP	0.9
D300L	10

Curing Condition 170℃ x 30min.

EVA Shoe Sole (2)			
Ingredient	Dosage (phr)		
EVA (VA content = 15%)	90	95	90
IR2200	10	5	5
EPDM 301	0	0	5
Stearic Acid	1	1	1
MgCO ₃	10	5	15
ZnO	2	2	2
TiO ₂	2	2	2
DCP	0.7	0.7	0.8
UNICELL- DX74AT / DX74M / DX3MI / DX74HP	3.0~4.0		

Condition for Curing and Foaming (mold depth : 10mm)
Using UNICELL-DX74AT 150℃~155℃ x 150kg/cm² 16~18min.
Using UNICELL-DX74M 155℃~160℃ x 150kg/cm² 16~18min.
Using UNICELL-DX3MI 155℃~160℃ x 150kg/cm² 18~20min.
Using UNICELL-DX74HP 180℃~185℃ x 150kg/cm² 16~18min.

EVA Shoe Sole (3)	
EVA (VA 25%)	40
EVA (VA 15%)	60
Stearic Acid	1
ZnO	2
Fluorescent	0.05
DCP	0.9~1.0
UNICELL-ADst	5

Roll Temperature 140℃
Foaming Condition 160℃ x 150kg/cm² x 15min.
Mold Depth 18mm

EVA Press Mold Foam



EVA Shoe Sole



EVA, Rubber Press Molding Foams					
Ingredient	Usage	Beach Sandal			Shoe Sole Sports Shoes
		Rubber	EVA	Rubber + EVA	
EVA (VA content = 15%)		0	100	75	100
Natural Rubber (RSS#3)		40	0	25	0
SBR (#1502)		30	0	0	0
HSR (Hycar#2057)		30	0	0	0
HSR (Hycar#2057)		1	1	1	0
Zn-Stearate		0	0	0	1.2
ZnO		5	0	0	0
CaCO3		80	50	0	0
MgCO3		0	0	0	25
Process Oil		5	0	0	0
DCP		0	1	1.1	1
Sulfur		2.2	0	0	0
UNICELL-AD series		8	6	6	6
1st Stage Condition					
Pressure		135	170	164	170
Temperature		150	150	150	150
Time		7~8	10	10	10
2nd Stage Condition					
Pressure		165			
Temperature		50			
Time		83			
Density of Foams		0.3	0.16	0.2	0.18

Rigid PVC Profile	
PVC resin (p=1000)	100
TLS	0.6
Filler	10~20
Plasticizer	2.4
Ba-Stearate	0.8
Ca-Stearate	0.8
Zn-Stearate	0.8
PMMA	0.25
ZnO	0.3
UNICELL-D1100	2

Extruder L/D 25 : 1
Extruder Temperature Feeding 120°C~140°C
Melting 150°C~160°C
Head 160°C~180°C
Die 200°C~210°C
Foam Density 0.4~0.5 g/cm³

Chemically Cross-linked PE Sheet (High Expansion Foam)		
LDPE	100	90
EVA		10
DCP	0.7~1.0	0.7~1.0
UNICELL-D1500PE	15~23	15~23

Roll Temperature 110°C~120°C
Extruder Temperature 110°C~120°C
Foaming Temperature 130°C~230°C

Non Cross-linked LDPE Extruded Foam	
LDPE	100
TiO2	0.15
UNICELL-C#850	0.20
UNICELL-C#709	0.80

Extruder Temperature Feeding 160°C
Melting 180°C
Die 140°C

Rigid PVC Foam	
PVC resin (p=1000)	100
Processing Aid	2~3
Impact Modifier	4~10
Stabilizer	1~2
Lubricant	1~3
UNICELL-DW	0.3~0.5

Extruder L/D 24 : 1
Extruder Temperature Feeding 170°C
Melting 180°C
Head 182°C
Die 175°C

Electro Beam Cross-linked PE Sheet (High Expansion Foam)	
LDPE	100
Ba-Stearate	0.3
Zn-Stearate	0.3
UNICELL-D1500CS	21

Roll Temperature 110°C~120°C
Extruder Temperature 110°C~120°C
Foaming Temperature 130°C~230°C

XLPE Pipe Cover



Extruded Foam (Profile and Pipe)					
Ingredient \ Usage	Sheet Profile	Sheet Pipe	Sheet Pipe	Sheet Profile	Sheet Profile
PVC (suspension)	100				
LDPE		100			
PP			100		
PS				100	
ABS					100
Cross-linking Agent		0.7~1.0			
Stabilizer (Ba/Zn)	3~5				
Processing Aid	5~10	0~1	0~1	0~1	0~1
Plasticizer	0~60				
UNICELL-D300/400/600	0.5			0.5	0.5
UNICELL-D800/D100/D1500		0.5	0.5		
Barrel Temperature Zone 1	150°C	150°C	160°C	150°C	150°C
Barrel Temperature Zone 2	160°C	170°C	170°C	160°C	160°C
Barrel Temperature Zone 3	170°C	190°C	190°C	170°C	170°C
Barrel Temperature Zone 4	180°C	200°C	200°C	180°C	180°C
Barrel Temperature Header	180°C	190°C	200°C	180°C	180°C
Barrel Temperature Die	160°C	170°C	180°C	160°C	160°C
Revolution of Screw	40rpm	50rpm	40rpm	40rpm	40rpm
Compression Rate	3.5 : 1	3.0 : 1	2.5 : 1	2.5 : 1	2.5 : 1

PP, PS, ABS, PE, PVC Extruded Foam (UNICELL-C series)				
Roll of UNICELL-C series	Foaming Agent		Nucleating Agent	
Resin	PP, PS, ABS, PE, PVC		PS, PE, PVC	
Foamed Material	Sheet	Film	Sheet	Film
UNICELL-C#709/C#850	0.5~0.7	0.4~0.6	0.4~0.6	0.3~0.5
Processing Temperature (°C)	190~220	190~220	210 max.	

PP, PS, ABS, HDPE, HIPS Extruded Mold Foam (UNICELL-TS)	
PP / ABS / HDPE / HIPS	100
UNICELL-TS	0.2~0.5

Compounding
Barrel Temperature back 15~20 min. in dry tumble
mid.1 177~182°C
mid.2 188~193°C
front 199~204°C
Die Temperature 216~221°C
Screw Speed 202~204°C
25~100rpm

XLPE Foam Sheet



NR, SBR Sponge (1)		
NR	30	65
SBR	47	15
NBR	23	20
Peptizer	0.3	-
Petroleum Resin	10	-
Sulfur	2	-
T-AZO	5	2.5
Stearic Acid	2	1.5
Wax	1	-
Silica	33.3	-
Filler	56.7	60
DEG	3.3	-
TiO ₂	15.7	-
ZnO	-	6
Scrap	-	80
Clay	-	40
DM	1.1	1
M	0.1	-
UNICELL-G	6.5	6
UNIPASTE	6.2	-

1st Curing 141°C~144°C x 5~7min.
2nd Curing 158°C~164°C x 6~8min.

NR, SBR Sponge (2)		
Ingredient	Usage	
Natural Rubber (RSS#3)		
SBR (#1502)		
HSR (Hycar#2057)		
Sulfur		
ZnO		
Stearic Acid		
MBTS		
TMTD		
CBS		
Processing Aid		
CaCO ₃		
Hard Clay		
White Carbon		
Process Oil		
UNICELL-AD Series		
Condition		
1st Stage		
Pressure	150	150
Temperature	141	138
Time	6~8	8~10
2nd Stage		
Pressure	50	50
Temperature	158	158
Time	7~9	6~8
Density of Foams	0.35~0.40	0.26

Wet Suit



Rubber Gaskets



NR, SBR Sponge (3)			
Ingredient	Usage	Rigid Sponge	Semi-rigid Sponge
Natural Rubber (RSS#3)		60	30
SBR (#1502)		40	30
HSR (Hycar#2057)		0	40
Sulfur		2.5	2.5
ZnO		5	5
Stearic Acid		2	1.5
MBTS		0.6	1
Processing Aid		6	5
Hard Clay		0	30
CaCO ₃		120	90
TiO ₂		5	5
UNICELL-G series		7	5
UNIPASTE		6	6
Condition			
1st Stage		semi-vulcanized foaming stage	
Pressure		100~150kg/cm ²	
2nd Stage		totally vulcanized foaming stage	
Pressure		30~50kg/cm ²	
3rd Stage		aging for the weatherability	
Temperature & Time		60~80°C, 24hrs	

SBR Sponge	
SBR	80
Silica	15
Process Oil	15
ZnO	5
Carbon	5
Stearic Acid	2
Sulfur	2
MBTS	0.3
TMTD	0.1
UNICELL-DK series	6

Press Condition 155~165°C
150kg/cm²
15~20min

Makeup Sponge



NR, PVC Foam			
Ingredient	Usage	Pipe Insulation	Floating
NBR (medium A.N.)		70	50
PVC (suspension resin)		30	50
Silica		30	60
Talc		35	20
CaCO ₃		15	0
Carbon Black		3	0
Tricresyl Phosphate		60	60
Chlorinated Paraffin		10	10
Antioxidants		1	1
Stabilizer (Ba + Zn)		1	1
Dibasic Lead Phosphite		1	0
ZnO		3	3
Stearic Acid		1.5	1.5
PEG		3	3
UNICELL-OH		1.5	20
Accelerator		2	0
DTH		0	1
Sulfur		3	2

Extrusion Condition Barrel Temperature 65°C
Head and Die Temperature 75°C
Cure Condition 140°C, 15min.

*DTH: Dipentamethylene Thiuram Hexasulfide

NBR Sponge	
NBR (A.N. 43%)	100
ZnO	5
Stearic Acid	2
HAF	10
Clay	40
Filler	30
Plasticizer	15
DM	0.6
Sulfur	2
UNICELL-G	6
UNIPASTE	6

Press Condition 160°C, 20min.

CR Sponge (1)	
CR	100
MgO	4
BLE	1.5
Wax	3
ZnO	1
Guanidine	0.75
LPO	30
Filler	50
UNICELL-OH	7.5

Press Condition 145°C, 15~17min.

CR Sponge (2)	
CR (PM-40)	65
CR (M-40)	65
Clay	20
Black Factice	20
Processing Oil	33
ZnO	15
MgO	5
Diphenyl Guanidine	1.3
Ethylene Thiourea	0.7
UNICELL-DK series	2
UNIPASTE-PII	1

Press Condition 155°C~165°C
100kg/cm²
6~10min.

Aging Condition 160°C
20min.

Rubber Pipe Insulation Foam



RB Foam for Out-sole	
RB 830	50
IR 2200	20
BR	30
Stearic Acid	1
Silica	10
TiO ₂	5
Polyethylene Glycol	2
BHT	1
DCP	0.4
UNICELL-D	1.5
UNICELL-G	1.5
UNIPASTE	3

Milling Condition (Banbury Mixer) 70~130°C, 5min.
Rolling Temperature 80°C
Press Temperature 150~165°C, 7~9min.
(mold : 6 x 180 x 220mm)
Post Cure Condition 70°C, 4hrs.

EPDM Weatherstrips	
EPDM (Royalene 525)	100
Clay	35
SL-90 Black	40
N-550 FEF Black	35
CaCo ₃	50
ZnO	4
Stearic Acid	1
Napthenic Oil	60
UNICELL-OHW2	8

Sheet	
Master Batch	333
UNICELL-OH	1
MBT	2
BUTAZATE	2
Sulfads	2
Sulfur	2

EPDM Sponge (1)		
EPDM	100	100
MT	150	-
Tale	-	100
Clay	-	95
Parafin Oil	100	125
ZnO	5	5
St-Acid	5	5
Sulfur	1.5	1.5
TT	1.5	1.5
M	0.5	0.5
UNICELL-OH	15	15

Curing Condition 165°C x 20min.

Dosage Sequence ingredient→EPDM
Banbury Condition 5~6min. upto 132°C

Dosage Sequence 1/2 MB→ingredient→1/2 MB
Banbury Condition 2~3 min. upto 82°C
Curing Condition
Precure 154°C, 3min.
Expansion 200°C, 3min.

*BUTAZATE: Zinc Dibutyldithiocarbamate
Sulfads: Diphentamethylene Thiuram Tetrasulfide

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