Typical Application in Elastomer

1. Products: Pu roller (cart wheel, roller skate wheel, etc.), rubber roller, mine sweeper, cyclone, etc.

For curing materials using diamine chain extenders, recommended : CUCAT-DG02, HA, PDAA, E02/E03, etc.

For curing materials using diol chain extenders, recommended: CUCAT-HS、HSF、AUCAT-301

1) The common features of catalyst adapted to curing materials using amine chain extenders

- Balance the competitive reaction between diamine/diol and -NCO, which is conducive to the growth of molecular mass and the improvement of physical properties.
- It hardly catalyzes the reaction between NCO and water, and the product is transparent without bubbles.
- With long flow period and fast post curing, which is similar to organic mercury. Representative product CUCAT-DG02. Please refer to the following Diagram ②
- CUCAT-E02/E03 is used for highly active amine chain extender such as DETDA, to produce high transparency products such as roller skate wheels. The products won't fog and turn opaque, and don't appear any yellow marks in sealed environment such as carton, and meet the requirements of international environmental protection regulations for toys.

Taking CUCAT-DG02 catalyst suitable for MOCA curing as an example, its typical characteristics are very close to organic mercury. See the following charts for details:

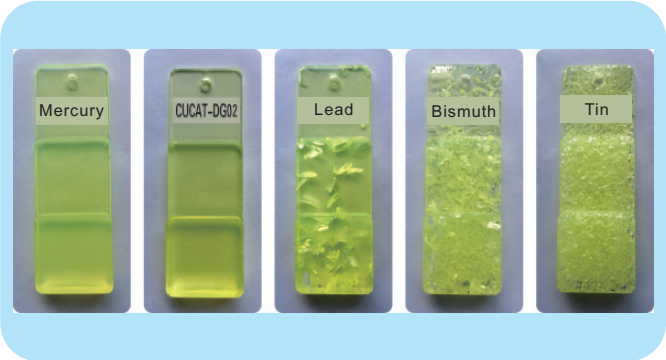


Diagram ① Features of water insensitive and non foaming

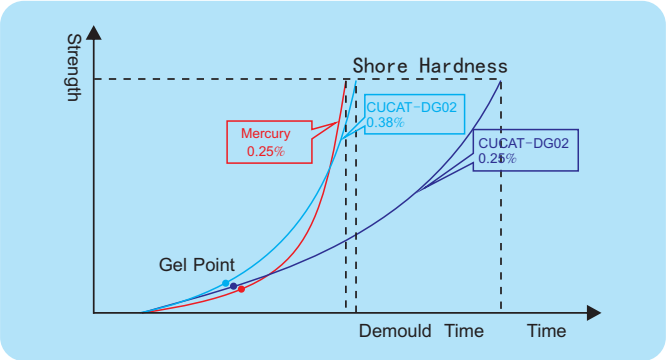


Diagram ② Process performance of slow before and fast after

2) The common features of catalyst adapted to curing materials using diol chain extenders:

- No foaming, reduce CO2 bubbles generated by moisture participating in the reaction, and solve the cured-surface problems such as foaming, bulging, peeling, pitting, cracking, etc.
- It can greatly reduce the shrinkage rate of products, reduce the stress cracking of products and the poor bonding of adhesive, which is due to the smoother rise curve of reaction temperature and more orderly controlled reaction.
- Reduce the process difficulty of products produced in MDI system and effectively reduce the rate of waste and defective products.

For MDI + PTMG + BDO system to produce high elasticity electric forklift wheels, CUCAT-HS is recommended.

For MDI+PPG+BDO system, CUCAT-HSF is recommended.

For MDI+Polyether+BDO system, CUCAT-HS or CUCAT-SW is recommended.

2. MDI Screen of polyester system, Printer Scraper

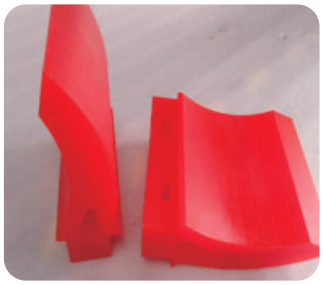
Recommended Products : AUCAT-RM301, AUCAT-202, CUCAT-SW05/SW06

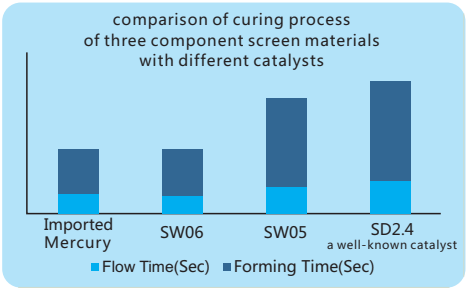
1) Rm301 has significant functions of thermal sensitivity and delayed catalysis, and has similar characteristics of organic mercury that does not catalyze the reaction between isocyanate and moisture. It is recommended to be used in MDI + Polyester + small molecular diol (BDO / EG) system with the following characteristics:

- Sufficient flow time and fast post curing. The initial viscosity rise of the material is not obvious, and the fluidity is good. It can quickly fill the mold cavity to meet the material filling at the fine grid of the screen. Collocates with an appropriate amount of 202, the flowable time of RM301 can be further prolonged without affecting the post curing.
- Insensitive to moisture, no bubbles. It hardly catalyzes the reaction of isocyanate with water to avoid problems such as bubbles, pinholes, pitting and cracking. After reaching the thermal sensitive point, the catalytic activity is higher and the reaction is more sufficient than that of organic tin and mercury catalyst.
- The thermal mutation temperature point is clear. Different isocyanate and active hydrogen systems have different thermal sensitive points, which are roughly distributed in the range of 60-80 ℃. The comparative experiment shows that when the oven curing temperature is slightly 10-20 ℃ higher than the thermal sensitive point, and the processability and physical properties are
- Environment friendly, not contain heavy metals such as mercury, lead, tin, etc.

2) In view of the dark color of RM301 and its coloring effect in most formulations, SW series light color catalysts were developed. SW05 is similar to a well-known catalyst SD2.4, but the post curing is slightly faster; SW06 is similar to organic mercury.

When designing the formula, it should be noted that the activity of the polyester polyol produced by different manufacturers is different, which has different effects on the catalyst of MDI formula system; RM301 and 201 are generally used in polyether and polyester systems , and SW series is only applicable to polyester systems.

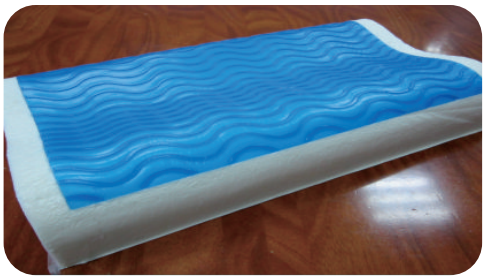


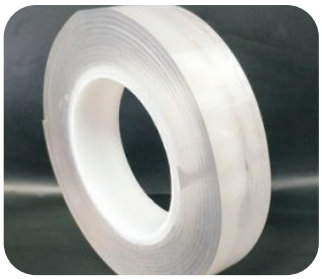


3. Soft PU products such as bedding, cool pillow, magic sticker, mouse pad, sucker, etc.

Recommended products: organic bismuth / zinc (BCAT, ZCAT, BX series), AUCAT-101, AUCAT-201, etc.

- Organic bismuth control gel time and catalyze the rapid growth of polymer chain. As an auxiliary catalyst, organic zinc can speed up the post curing and shorten the molding time
- The combined use of bismuth and zinc can adjust the gel and molding time according to the formulation and process requirements.
- AUCAT-101/201 are reactive catalysts with catalytic characteristics similar to bismuth / zinc catalyst, but they are grafted to polyurethane macromolecules in the final reaction, that is why they will not produce odor, while the free state of organic bismuth and zinc catalyst in the product will emit odor. 101/201 can be premixed with polyol components in advance and stored stably without inactivation, while the pre addition of bismuth and zinc will gradually hydrolyze and inactivate, which must be added and used on site, and it is inevitable that the curing will be slower and slower due to the gradual failure of the catalyst under the working conditions of high humidity and high temperature in summer. Organic bismuth / zinc catalyst will cause fogging and whitening to some transparent products after a period of time and lose transparency, while AUCAT-101/201 can avoid the problems of reducing transparency, fogging and whitening.





4. Electronic potting glue, LED light strip glue, nameplate glue

1) HAB, K6 and PDAA are more suitable for transparent electronic potting glue, which are substitutes for organic mercury catalyst.

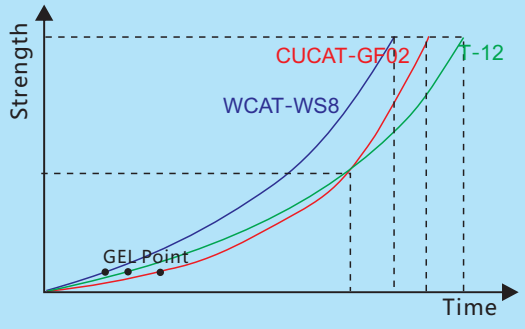
Reduce bubbles and low sensitivity to moisture. If it collocates with chain extender TDMA-DLH02, it can effectively avoid or reduce stubborn bubbles at tin welding parts.

Catalytic activity is slow before and fast after: collocates with post curing catalyst T30, it can greatly shorten the post curing time without shortening the flow time, and has the same effect of accelerating the post curing of aliphatic non yellowing potting glue.

K6 has weak thermal activity, which is similar to the imported well-known catalyst 604.

comparison of curing process in castor oil system with T12 and GF02/WS8

(I material: Pm200; P material: Castor Oil; Forming Hardness:40A)



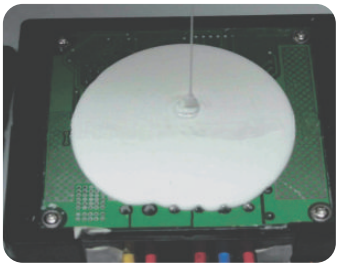
2) WCAT-WS8 and CUCAT-GF02 are recommended for electronic potting glue with castor oil as raw materials, which is better than common T-12. The description is as follows:

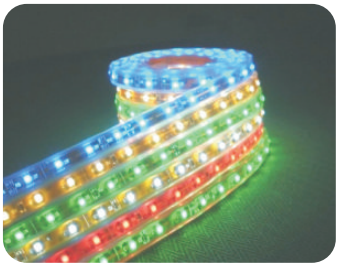
Ws8 has higher catalytic activity than T-12 and is more suitable for machine perfusion.

Compared with T-12, GF02 has more obvious process characteristics of slow before (long flow period) and fast after (fast curing).

Gf02 relatively reduces the catalytic reaction between isocyanate and water, and effectively solves the problems such as bubbles and pinholes on the casting surface.

It does not contain dibutyltin, which meets the environmental protection requirements for the export of electronic products.





5. Thermal Plastic Polyurethane (TPU)

Recommended products: BCAT-E20CX, ZCAT-T50 and other special tin free catalysts.

E20CX is more effective than general organic bismuth in reducing side reactions at high temperature; Improve anti-hydrolysis stability and aging resistance of TPU

T50 and E20CX are used to catalyze the synthesis of low hardness TPU in the ratio of 3~15:1, which can lower the hardness, significantly reduce the permanent deformation and improve the elastic recovery.

6. RIM (Reaction Injection Moulding) microporous elastomer

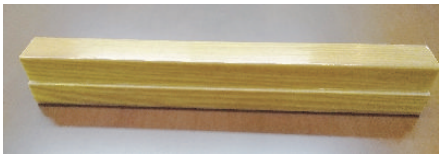
Recommended products: FOCAT-8003M, AUCAT-RM301, CUCAT-NX100 etc.

Not contain organic tin, sufficient flow period, fast gel strength improvement and reduced shrinkage.

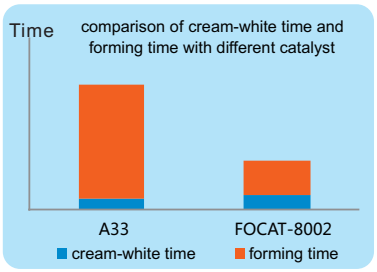
7. Pultrusion Polyurethane

Recommended products: CUCAT-S01, CUCAT-RM60, AUCAT-RM301, CUCAT-NX100

sufficient flow period, fast gel strength improvement and reduced shrinkage.



8. Application in Polyurethane Shoe Material



8.1 Catalyst for Sole Liquid

Recommended products：FOCAT-8002

- Used for foaming sole, it has longer milky time than A33, but shorter forming time.
- Improve production efficiency and reduce comprehensive cost.

8.2 Catalyst for Shoe Adhesive

Recommended products：AUCAT-1301、Organic Bismuth BCAT Series、Organic Zinc ZCAT Series

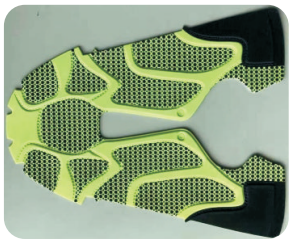
AUCAT-1301 is recommended for synthetic adhesive for shoes, with the following characteristics:

- It does not contain tin and is environmentally friendly, ensuring that it meets the stringent requirements of environmental protection regulations at home and abroad.
- The reaction viscosity of the resin increases rapidly, the synthesis time is shortened, and the process stability is the same as that of organic tin. Solve the problems of low catalytic activity of organic bismuth, slow increase in viscosity or even failure in viscosity (slow increase in molecular mass or even failure to produce resin of high molecular mass). When synthesizing adhesive resin for shoes, the Rod-climbing time is accurate and stable, and the production efficiency is the same as that of organic tin.
- The catalytic activity is close to that of organic tin, more than 20 times higher than that of organic bismuth. The dosage is slightly higher than that of organic tin, but only one tenth of that of organic bismuth. In fact, even if the dosage of organic bismuth is increased, the activity is still significantly insufficient.
- It does not affect the transparency of polyester resin.

8.3 Catalyst for KPU Vamp Rubber

Recommended products：CUCAT-SW02D，CUCAT-T30

- It does not contain tin and is eco-friendly, meeting the requirements of export regulations and foreign first-line brand shoe enterprises.
- No bubbles:ffectively reduce CO bubbles generated by the reaction between oistureand isocyanate, and avoid quality problems such as bubbles and crackingT30 is less sensitive to moisture. If W2ollocateswith T30, the foaming phenomenon under high temperature and high humidity conditions can be greatly educd



- Low viscosity, long flow period, no fracture of fine glue filament: The initial viscosity of mixed material rises slowly and has good fluidity. It can quickly fill the complex mold cavity to ensure the continuous gluing of micro patterns.
- Fast post curing speed: The strength increases rapidly after gelation, which can increase the production efficiency. The strength increased even faster after gelation if collocates with T30.

8.4 Catalyst for Soft Rubber Insole, Raised Heel

Recommended products: organic bismuth zinc (BCAT, ZCAT, BX series), AUCAT-101, AUCAT-201, etc.

- Organic bismuth control gel time and catalyze the rapid growth of polymer chain. As an auxiliary catalyst, organic zinc can speed up the post curing and shorten the molding time
- The combined use of bismuth and zinc can adjust the gel and molding time according to the formulation and process requirements.
- AUCAT-101/201 are reactive catalysts with catalytic characteristics similar to bismuth / zinc catalyst, but they are grafted to polyurethane macromolecules in the final reaction, that is why they will not produce odor, while the free state of organic bismuth and zinc catalyst in the product will emit odor. 101/201 can be premixed with polyol components in advance and stored stably without inactivation, while the pre addition of bismuth and zinc will gradually hydrolyze and inactivate, which must be added and used on site, and it is inevitable that the curing will be slower and slower due to the gradual failure of the catalyst under the working conditions of high humidity and high temperature in summer. Organic bismuth / zinc catalyst will cause fogging and whitening to some transparent products after a period of time and lose transparency, while AUCAT-101/201 can avoid the problems of reducing transparency, fogging and whitening.

8.5 Catalyst for transparent PU Rubber on the outer layer of sole

Recommended products) : AUCAT-K7，CUCAT-DG02，CUCAT-T30

- No bubbles: effectively reduce CO2 bubbles generated by the reaction between moisture and isocyanate, and avoid bubble defects.
- Reduce blackening and discoloration: solve the problem of gradual discoloration and blackening after ordinary catalyst contacts the rubber sole.
- Long flow period, fast forming, improve production efficiency.
- It is environmentally friendly and does not contain mercury / lead / tin, meeting the requirements of export regulations and foreign first-line brand shoe enterprises.

Attached table1: catalyst selection guide for application in elastomer

Product Category	Product Model	Recommend for application in various fields							
		PU Wheel Rollers Cyclone	Gel Products Magic Sticker Cold Pillow	Screen Scraper	Sealed Glue for: Electronics, LED, Nameplate, etc.	TPU	Shoe sole Vamp Heel	RIM	Pultrusion Polyurethane
Catalyst	CUCAT-DG01/DG02	★★			★★				
	CUCAT-K6	★★	★		★★		★		
	CUCAT-HAB/HAA	★			★★				
	CUCAT-E02/E03	★★							
	CUCAT-ET01	★	★				★		
	CUCAT-PDAA	★			★				
	CUCAT-HSF	★★							
	CUCAT-HS	★★		☆					
	CUCAT-SW02D						★★		
	CUCAT-S01								★★
	CUCAT-S9A						★★		
	CUCAT-SW05/SW06			★★				☆	
	CUCAT-RM50/RM60							★★	
	CUCAT-GF02				★★				
	CUCAT-NX100						★★	★	★
	WCAT-WS2/WS8				★				
	AUCAT-101	★	★		★		★	★	
	AUCAT-201/202	★	☆	★★	★		★		☆
	AUCAT-1001E	★			★			★★	
	AUCAT-RM301	★		★★	★			★	★
	ZCAT-T50	☆	★		★	★★			
	FOCAT-8001/8002/8003M						★★	★★	
	BCAT/ZCAT series	☆	★★		☆	★	★		
Anti-yellowing Antioxidant	UVK-CL2	★★	★	★	★★	★	★★	★	★
	UVK-TA	★	★	☆	☆	☆	★	★	★
Abrasion-resistant Agent	CUBD-NM01	★★		★★			★★	★	
	CUBD-NMF	★		★		★	★	★	
Defoamer	YRXP-02	★	★	★	★	★	★	★	★
	YRXP-06	★		★		☆	★	☆	☆
Antistatic Agent	CUCE-W	★	★	★		★	★	★	★
Moisture Removing Agent	CUWR-WB50T	★		★	☆		★	☆	☆
	CUWR-WB20	☆	☆	☆	☆	☆	☆	☆	☆

Notes: 1. Meaning of Icons：★★ — Strongly recommended ★ — recommended ☆ — usable

2. This guide is only a rough directional guidance. The correctness in various aplication and formulation systems is not guaranteed. The exact suitability shall be determined through communication with the engineer.

3. The above are only some of the products in application.

Attached table2: catalyst selection guide (divided by reaction system):

Product Model	①Applicable System															
	Aromatic Isocyanates															Aliphatic iso-cyanate
	TDI				MDI50/PAPI				②PMDI/C-MDI						Castor Oil	
	PPG/PTMG		Polyester		PPG/PTMG		Polyester		PPG		PTMG		Polyester			
	Diamine	Diol	Diamine	Diol	Diamine	Diol	Diamine	Diol	Diamine	Diol	Diamine	Diol	Diamine	Diol		
CUCAT-DG02 *	★★	☆	☆		★★	☆	★★		★★	☆	★★	☆	☆			
CUCAT-K6 *	★	★	☆	☆	★	★	☆	☆	★	★	☆	★	☆		☆	★
CUCAT-HAB/HAA	★	★	☆	☆	★	★	☆	☆	★	★	☆	★	☆		☆	★
CUCAT-HA	★	☆			★	☆			☆	☆	☆	☆				
CUCAT-E02 /E03	★	★	☆	☆	★	★	☆		★	★	☆	☆				☆
CUCAT-ET01	☆	☆	☆		★	★	☆		★	★	☆	☆				
CUCAT-PDAA	★	☆	★	☆	★	★	☆	☆	☆	☆		☆				★
CUCAT-HSF										★★		★		☆		
CUCAT-HS												★★	★	★★		
CUCAT-SW02D			★★				★					☆	★	★★		
CUCAT-SW05/SW06													★	★★		
CUCAT-RM50/RM60										★		★	★	★		
CUCAT-GF02						☆								☆	★★	
WCAT-WS8		★				★									★★	
WCAT-WP01																★★
WCAT-WH03		★				★										
AUCAT-101	★	★	☆	☆	★	★	☆	☆	☆	★		☆			☆	★
AUCAT-201/202	★	★	★	★	★	★	☆	★	★	★	☆	☆			☆	★
AUCAT-1001E	★	★	☆	☆	★	★	☆	☆	★	★		☆			☆	☆
AUCAT-AS11	★	★	☆	☆	★	★	☆	★	★	☆					☆	★
AUCAT-1301 *	☆	☆	☆	☆	☆	☆	☆	☆		☆		☆				★
AUCAT-RM301	★	★	★	★	★	★	★	★	★	★★	★	★★	☆	★★		★★
FOCAT-8002		★★		★★		★★		★★		★★		★★		★★		
FOCAT-8003M		★★				★★				★★		★★				
ZCAT-T50	★	★	★	★	★	★	★	★	★	★	★	★				★
BCAT/ZCAT 系列	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆				☆

Notes: ① Meaning of Icons：★★ — Strongly recommended ★ — recommended ☆ — usable * — The catalyst has thermal activity
② PMDI — Pure MDI；C-MDI — Carbodiimide modified MDI

(This guide is only a rough directional guidance. The actual formula and process are complex and diverse, which is subject to actual verification)