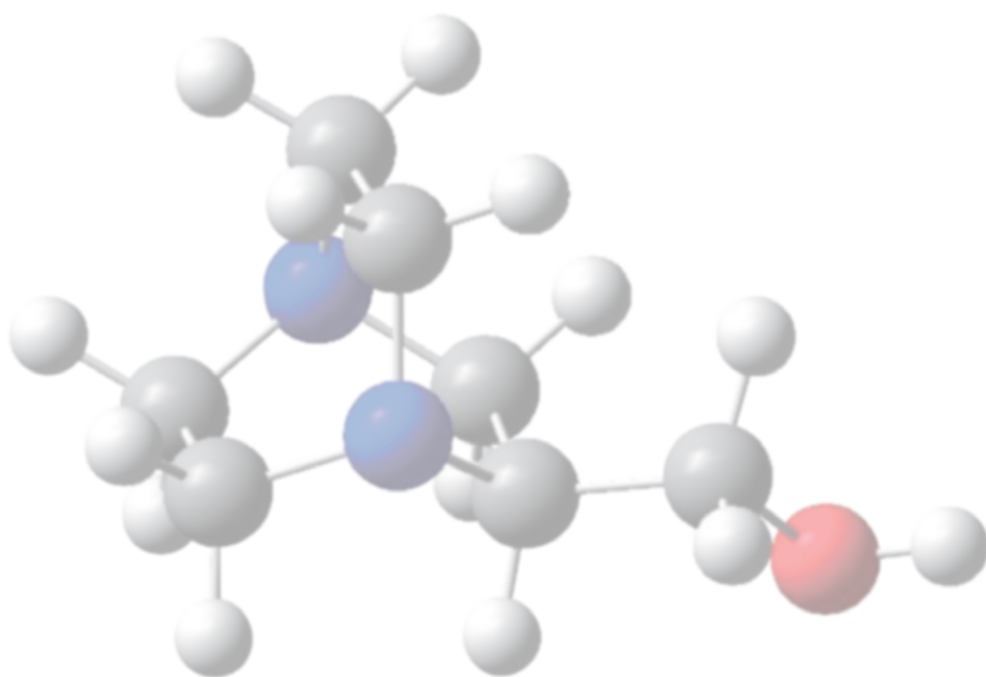




RZETA[®]

Novel Reactive Amine Catalyst



TOSOH CORPORATION

|| Polyurethane Catalyst Business

Tosoh is Japan's largest producer of caustic soda and ethylenedichloride (EDC) and therefore, is a leading supplier of ethyleneamines with a strong global position.

Tosoh also manufactures TEDA, Toyocat, and RZETA which are amine catalysts for polyurethanes as ethyleneamine derivatives.

Tosoh's catalysts are efficient as well as reliable for polyurethane foam formation. Tosoh can modify these products to meet even the most demanding production conditions worldwide.

(*)TEDA, TOYOCAT, and RZETA are registered trademarks of Tosoh Corporation in Japan and other countries.



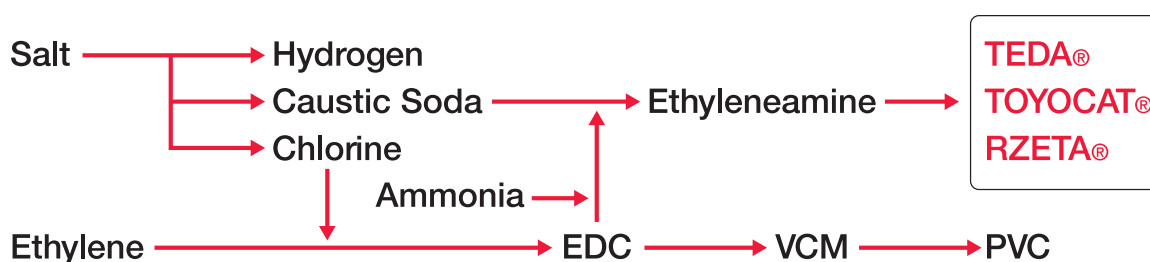
|| Company Profile

Tosoh Corporation evolved from humble beginnings in 1935 as a domestic producer of caustic soda and soda ash. Today, the company is a multinational corporation that generates an array of products to suit modern lifestyles and that contribute to the development of cutting-edge products and technologies.

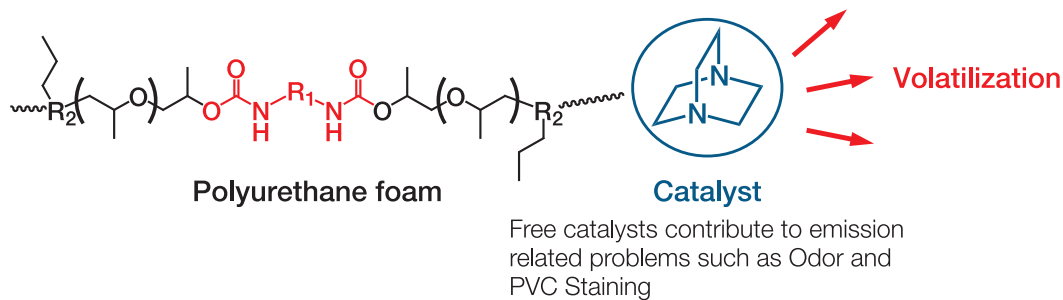
The Tosoh Group comprises more than 130 companies and almost 40 of those firms are located outside Japan. Together, Group companies employ a multiethnic workforce of over 11,000 and generate net sales of ¥668.5 billion (US\$7.1 billion). Tosoh is a global supplier of inorganic chemicals, petrochemicals, and specialty materials.

TEDA, TOYOCAT, and RZETA, are just three of the many product lines that make Tosoh's contribution to modern life ubiquitous and profound.

|| Manufacturing Process Flow



II Amine emission



Odor : compromises working conditions and safety of end-products and users

Irritating : blue haze (eye irritation), VOC

Contamination : PVC&PC staining, Fogging

II Problems using reactive amine catalysts

Decreased catalytic activity during the foam reaction

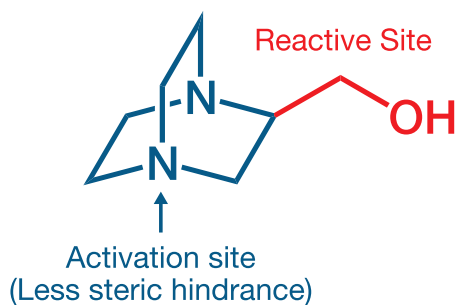
Inferior foam physical properties and durability

Imperfect reaction, residual amine catalysts in PU foam

Limited options to promote the gelling reaction

➡ Demand for **Strong Reactive Gelling** catalyst

II RZETA - Novel reactive amine catalyst for polyurethane foams -



Safer Alternative
Strong Gelling
Eco-Friendly

*commercialized RZETA is diluted product.
(amine 33%, DPG 67%)

|| Safer Alternative

- High boiling point and Low vapor pressure


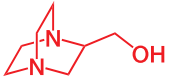
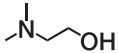
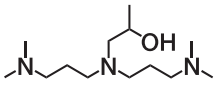
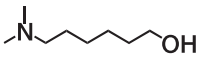
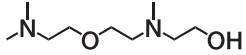
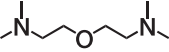
➡ **Low volatility**

- High LD₅₀ (lethal dose)

➡ **Low toxicity**

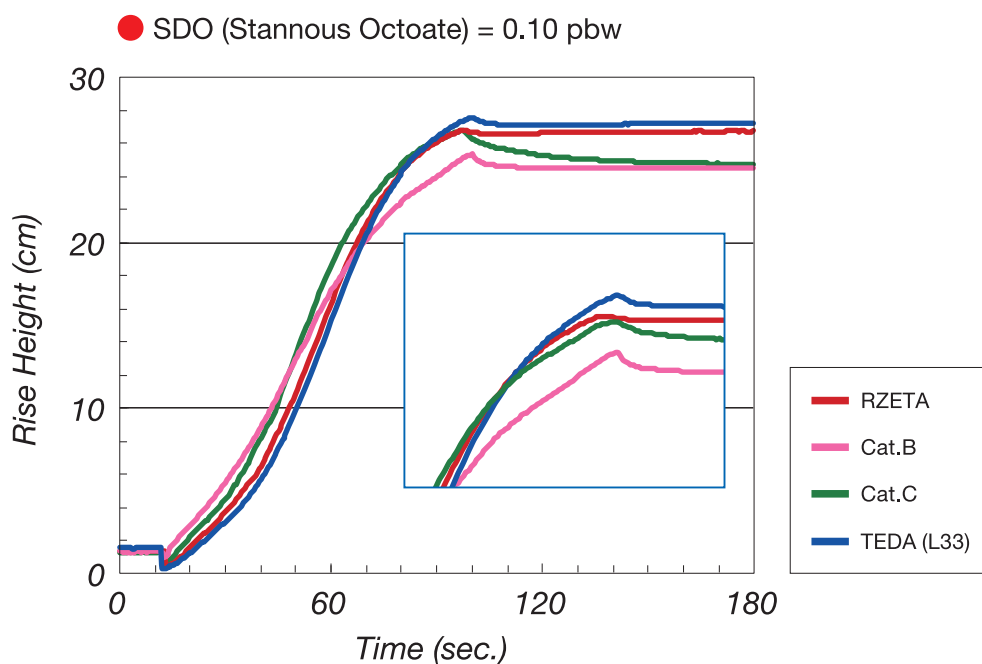
		TEDA	RZETA crystal
aspect		white crystal	white crystal
Mw		112.2	142.2
m.p. (°C)		160	72
b.p. (°C)		174	281
Vapor Pressure (kPa)	100°C	7.8	0.08
	150°C	52.1	1.97
LD ₅₀ by rat (mg/kg)		1,700	over 2,000

|| Strong Gelling Catalytic activity

Amine catalyst		Gelling activity k ₁ w (×10)	Blowing activity k ₁ w (×10)	Ratio (×10 ⁻¹) (Blow/Gel)
TEDA		10.9	1.5	1.3
RZETA crystal		8.0	1.2	1.5
Cat.B		2.9	0.4	1.2
Cat.C		3.6	0.8	2.3
Cat.D		2.3	0.6	2.5
Cat.A		3.4	10.5	30.4
ETS		3.0	11.7	39.0

Strong Gelling

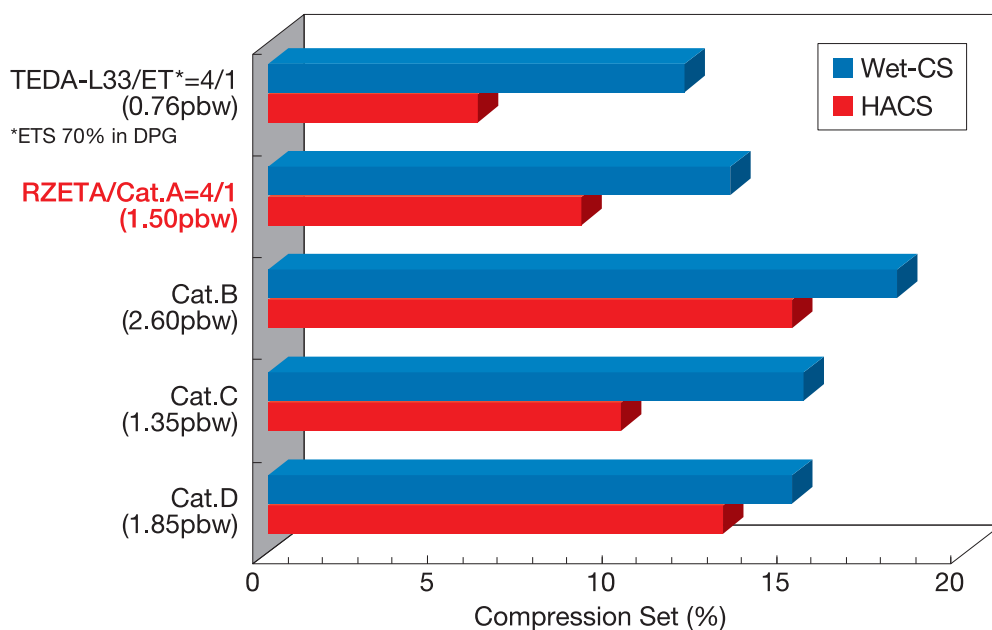
Rise profile



RZETA exhibits small settling even with low SDO amount.

Strong Gelling

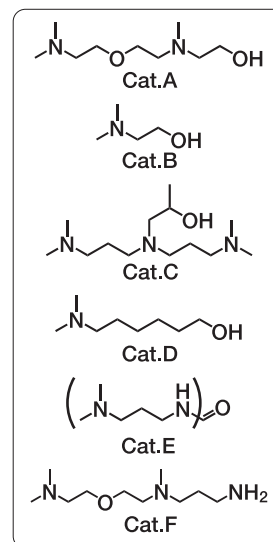
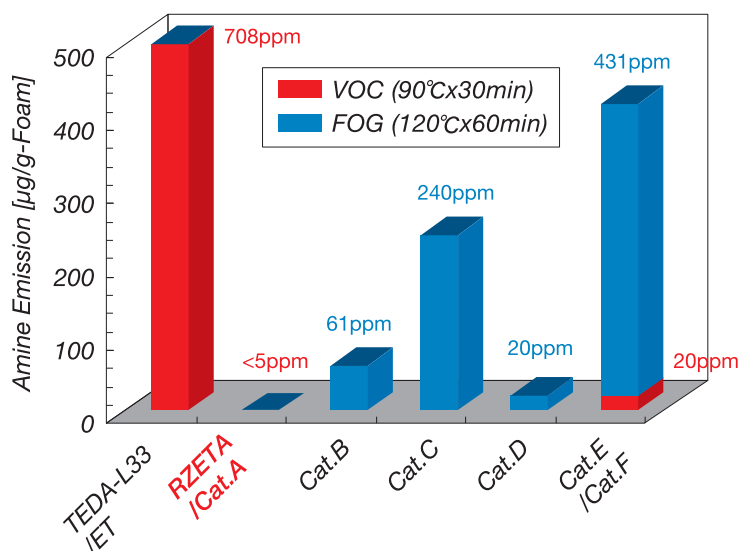
Durability performance



RZETA's strong gelling activity results in better durability performance.

|| Eco-Friendly VOC and Fogging test

- VDA278 method
VOC: -C20, FOG: C16-C32



RZETA markedly reduces amine emissions.

|| Eco-Friendly PVC staining test

- Foam was placed in a closed glass flask in the presence of PVC sheet at 100°C for 72 hr.



Foam sample: 7×7×3cm, PVC: 4×4cm

RZETA exhibits less PVC staining.

|| Eco-Friendly Odor test

● VDA270 method and Large scale chamber test

Test method		VDA270	Large scale chamber test
Test piece		5×5×2cm	35×35×10cm, 6pieces
Condition		80°C×2 hours	40°C×4.5 hours
Evaluation		Test of smell (3 panelers)	Triangle odor bag method
Result		Odor intensity	Odor concentration ^{a)} (Odor index ^{b)})
	RZETA	2.5 (sweet, aromatic)	12.6 (11)
	TEDA	3.0 (irritating, Fishy)	25.1 (14)

a) Odor concentration is a dilution rate for invaliding odor.

b) Odor index = $10 \times \log$ (Odor concentration)

RZETA reduces odor and lack the amine smell.

|| Product Information

● Typical Properties

Item	Physical data
Amine Value (mgKOH / g)	250 ~ 276
Water content (%)	1.0 Maximum
Appearance	Yellowish Liquid
Specific Gravity (H ₂ O = 1, @20°C)	1.06
Freezing Point (°C)	<0
Boiling Point (°C)	>230
Vapor Density (air = 1)	4.74
Flash Point (°C)	137
Solution in water	Soluble
pH (10% aq., @20°C)	10.9
Calculated OH number (mgKOH / g)	689

● Package

200kg (200L drum), 20kg (20L pail)



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