K-KAT®

Catalysts for Polyurethane Foam

K-KAT® Catalysts for Foam

K-KAT organometallic catalysts have been developed as non-toxic, HAPS-free, low-emission, and low-odor alternatives to tin and tertiary amines for polyurethane foam applications. K-KAT bismuth and zinc catalysts are excellent amine-alternative gelling and blowing catalysts for HFO-blown rigid spray foam insulation (SPF) and flexible molded foam.

K-KAT Bismuth Catalysts

The K-KAT bismuth catalysts have significantly improved hydrolytic stability while maintaining very high gelling efficiency and especially strong front-end reactivity. Therefore, they are very well suited for applications requiring very fast foam setup in low temperature environments (e.g. in SPF), and for tin-replacement (e.g. in slabstock).

Product	Metal Content	Attributes / Uses
XK-651	25%	Bismuth carboxylate with proprietary hydrophobic ligand technology. Best overall stability and performance in HFO-blown foams.
682LV	21%	Bismuth-amine complex. Most hydrolytically stable bismuth catalyst, highest reactivity efficiency.

K-KAT Zinc Catalysts

The K-KAT zinc catalysts provide an excellent overall balance of hydrolytic stability, back-end reactivity/delayed action, and gel reaction selectivity, making them excellent catalysts for foam applications requiring longer open times and good foam flowability (e.g. in molded foams).

Product	Metal Content	Attributes / Uses
XK-614	13%	Zinc-amine complex. Best overall stability in HFO-blown foams. Delayed action provides good foam flowability.
XK-633	18%	Zinc carboxylate. Often used as a co-catalyst with bismuth. Gives a balance of performance with excellent hydrolytic stability and foam flowability.

Formulators note

K-KAT bismuth and zinc catalysts can be combined as co-catalysts to provide a synergy that balances front and back-end reactivity for a smoother foam rise profile.

Hydrolytic Stability Performance

K-KAT XK-651 and K-KAT 682LV were designed to have significantly improved hydrolytic stability while maintaining high catalytic activity, in comparison to a conventional bismuth carboxylate, which showed very poor hydrolytic stability with severe hazing after only 24 hours of room temperature storage (**Image 1**).

Image 1. ***Hydrolytic Stability Performance***
Polyol spiked with 0.1% water, 24 hours @ RT
0.75% catalyst on total resin solids (TRS)

K-KAT XK-651 | ***K-KAT 682LV*** | Conventional Bismuth Carboxylate

Spray Polyurethane Foam (SPF) Formulation

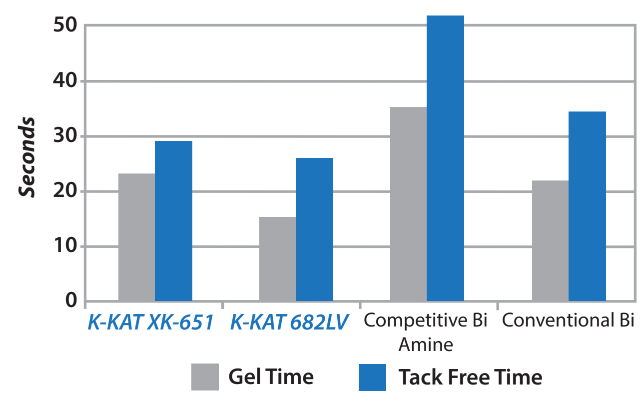
Component 1	Supplier	Description	OHv (mgKOH/g)	eq. wt (g/eq)	pbw (%)	pphp
Terol® 649	Huntsman	Polyester polyol	375	150	46.5	60.0
Voranol® 470X	Dow Chemical	Polyether triol	34	1650	23.3	30.0
Jeffol® SG 360	Huntsman	Polyether polyol	360	156	7.8	10.0
Antiblaze® TCPP AB80	Albermarle	Chlorinated phosphate ester			7.8	10.0
Silstab® 2100	Siltech	Silicone surfactant	83	676	1.2	1.5
DI water	N/A	Deionized water	6228	9	1.9	2.5
Catalysts	N/A	Bismuth catalyst			varied	varied
Solstice® LBA	Honeywell	HCFO-1233zd(E)			10.8	13.9
Component 2						
Lupranate® M20	BASF	Polymeric MDI	31.5	133.3	100.0	

Catalyst Efficiency Comparison

K-KAT® 682LV is the most efficient catalyst followed by K-KAT XK-651. The Competitive Bi-Amine compound is the slowest of the four bismuth catalysts compared in **Graph 1**.

Graph 1. ***Initial Reactivity Comparison***

Catalyst dosage constant at 0.45% on TRS

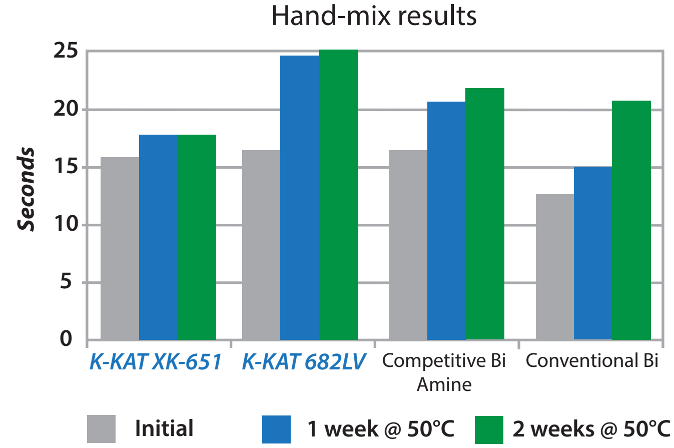


Accelerated Aging Stability Comparisons

The gel time stability for K-KAT XK-651 was excellent, with a change of just 13% over the two weeks of aging. The least stable catalyst was the Conventional Bi catalyst as shown in **Graph 2**.

Graph 2. ***Gel Time, seconds***

Hand-mix results

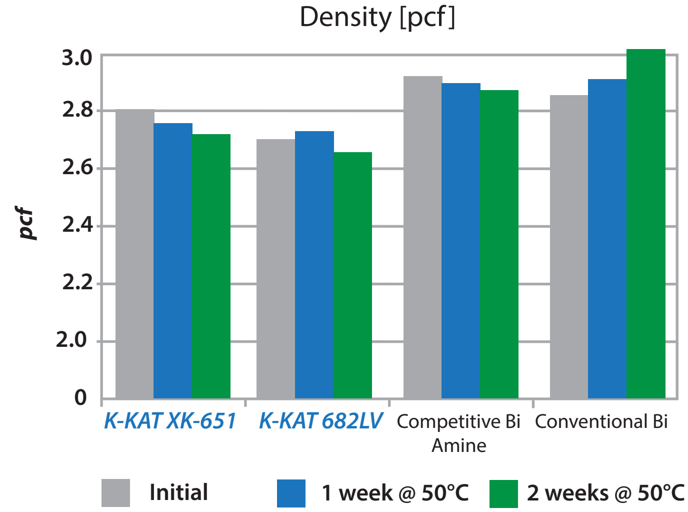


Free-rise Density Stability

Free-rise density stability is a direct indication of HFO-stability. An increase in density over the accelerated aging period indicates a break down of the blowing agent, causing a possible destabilization of the foam leading to cell collapse.

Partial destabilization was observed for the conventional Bi catalyst at 2 weeks aging, as evidenced by partial collapse of the foam bun (i.e. splitting, and sagging). K-KAT® 682LV and XK-651 yielded good foam stability and did not cause foam density to increase.

Graph 3. ***Accelerated Aging Stability Comparison***



Hand-Mix Study Foam Quality

Image 2. Hand Mixed Foam

Image 3. Horizontal Cross-section

Image 2 and **Image 3** show good foam appearance and cell structure in foams formulated with K-KAT catalysts.

Applications

- Rigid foam insulation
- Cavity sealing foam
- LD-SRIM
- Integral skin foam
- Flexible/semi-rigid/rigid molded foam
- Microcellular elastomers
- Slabstock foam

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