

TEDA & TOYOCAT NEWS

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It is a great pleasure to present our fifth issue of the TEDA & TOYOCAT News. We hope it will assist you to obtain maximum benefit from our products. We would be glad to supplement this information at some mutually convenient time. In the meantime, please do not hesitate to call upon if there is some other way in which we can be of assistance.

TOPICS

TOSOH EXPANDS AMINE CATALYST & ETHYLENEAMINE PLANTS

Tosoh Corporation is strengthening its tertiary amine catalyst "TEDA & TOYOCAT" business. As a part of this policy, Tosoh has already begun the expansion for PU catalyst and will continue to gradually increase capacity. Eventually, Tosoh will realize a production capacity increase of 40% over present day capabilities. This expansion based upon the growing demand for PU catalysts especially in Asia, and the fact that development of new catalysts for CFC elimination as well as technical improvement are becoming successful.

At the same time, an expansion and streamlining of the sales network is being implemented. Tosoh is establishing a new Singapore branch covering South-East Asia, in addition to the existing offices in USA (Atlanta), Europe (Amsterdam) and Japan (Tokyo). Tosoh's target with both the expansions of the plant and the new sales organization is to cover the expected market growth in Asia, and to improve the global sales network, especially in marketing and technical services.

Tosoh has announced a capacity increase for ethyleneamines, which are the main raw materials for tertiary amine catalysts TEDA & TOYOCAT. It will be implemented gradually and a total capacity of 40,000 tons per year will be reached by the end of 1997. Ethylene-

amines have a variety of applications, such as epoxy resin curing agents, paper additives, chelating agents, and so on. Based on the ethyleneamine feedstocks, Tosoh has conducted R&D work in the PU catalyst field for many years. Consistent with these capacity increases and sales streamlining, Tosoh will speed up the worldwide marketing efforts of TEDA & TOYOCAT products.

NEW IMIDAZOLE CATALYSTS

Toyocat - F10 and DM70

Tosoh has promoted imidazole based catalysts from 1989 for a variety of applications in order to cope with CFC elimination. For example, at SPI'89, Tosoh presented F94 in water blown rigid foams for the improvement of friability, and its patents have been approved in each region (USA, Europe and Japan). Secondarily F2 and F4 were introduced in all-water blown flexible foam systems in SPI'90 and SPI'91. For water blown integral skin foams, the effectiveness of F2 was also presented at SPI'93.

Through recent development, Tosoh has developed other new imidazole based catalysts, Toyocat - F10 & DM70 which have less odor and high catalytic activities compared with the former grades F2 & F94. Tosoh believes the customers will greatly benefit from the many advantages of these imidazole catalysts, which are described below.

REVIEW OF TEDA & TOYOCAT

NEW IMIDAZOLE CATALYSTS

Toyocat - F10 and DM70

Tosoh's new imidazole catalyst F10 & DM70 provide the following advantages in a variety of applications, the characteristics of which are already recognized by many customers with the former grades F2 & F94.

New Catalysts Toyocat-F10 & DM70 provide similar effectiveness in water blown systems as shown in Figure-1 & 2 (Hot cure), Table-1 (HR) and Table-2 (Rigid).

Flexible foams

- provide a wide processing range and low density foams.
- improve air-flow function.
- improve cure & moldability.
- especially effective in water rich systems which uses EO-rich polyols.

Integral Skin foams

- improve surface skin and moldability

Rigid foams

- improve friability and adhesive strength in water blown systems.
- e.x. in sprayed foam, board & panel, synthetic wood, and so on.

Although F10 & DM70 can be applied to all applications, it must be informed that both grades contain solvent since new imidazole is a solid at room temperature. F10 contains dipropylene glycol and DM70 contains ethylene glycol as a solvent.

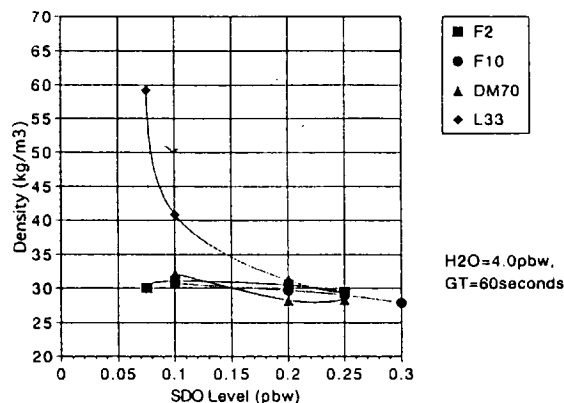


Figure 1. The influence of SDO level on foam density for each amine catalyst.

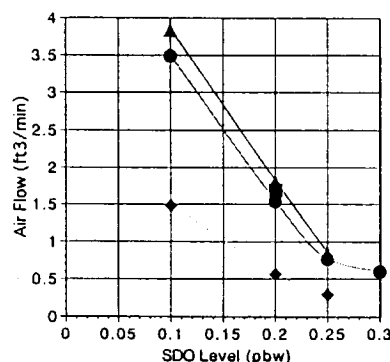


Figure 2. The influence of SDO level on Air flow for each amine catalyst

Table 1. HR foams.				
Catalyst (pbw)	L33/ET ¹⁾	F10	F2	DM70
	0.64	1.21	1.30	1.23
Free (2L Polyethylene cup)				
CT (sec)	8	9	9	7
GT	65	64	64	65
RT	84	87	82	87
C.D.(Kg/m³)	34.0	35.1	35.9	35.6
Mold (25x25x8cm, 50°C)				
O.D.(Kg/m³)	49.9	49.1	49.4	49.1
C.D.	46.6	46.7	46.4	46.8
ILD (Kgf/314cm²)				
25%	26.0	29.0	30.4	29.4
65%	86.4	96.0	101.8	97.2
Tear strength (Kgf/cm)				
	0.79	0.91	0.93	0.83
Tensile strength (kgf/cm²)				
	1.94	2.00	2.05	2.09
C-set (%) ²⁾	25.5	17.7	17.5	18.2
Cure (%) ³⁾	75.3	82.3	83.1	82.5

1) L33/ET=5/1 2) 95%RH, 22hrs at 50°C
 3) Demolded foam was immediately compressed at 62.5% for one minute. 5 minutes later, recovery % was measured, which are shown as curing function.

Table 2. Reaction and physical properties on water rich blown rigid foam system.				
Catalyst (pbw)	DMCH	DM70	F10	F94
	2.4	3.9	4.2	3.5
Free rise foam ¹⁾				
CT (sec)	15	19	18	19
GT	50	51	50	50
TFT	60	59	58	58
RT	77	73	74	71
C.D. (kg/m³)	26.4	28.0	28.3	27.4
Panel mold foam ²⁾				
C.D. (kg/m³)	28.0	30.4	30.5	29.3
Adhesive strength (kgf/cm²)				
	0.02	0.66	0.34	0.55

1) Open-top polyethylene beaker (2L)
 2) Aluminum Mold : 50x50x14.5cm

TECHNICAL VIEW

**NEW QA CATALYSTS FOR PIR
"TR20 & TR30" AT PU EXPO '96**

The POLYURETHANES EXPO '96 will be held on October 20-23 in Las Vegas, TOSOH will introduce innovative quaternary ammonium salt catalyst (QA) and a new rise rate measuring system (described in the INFORMATION section at page 4).

TOSOH Corporation has examined a variety of isocyanurate catalyst in CFC free PIR foam system and has developed the unique QAs "Toyocat-TR series". TR series are based on a non-fugitive amine and features reduced odor when compared with standard QA and tertiary amine catalysts. Toyocat-TR20 and TR30 accelerated the initial foaming reaction and provided much smoother rise profiles as shown in Figure-8 (Page-4). While, conventional alkali metal catalyst EHK (potassium 2-ethylhexanoate) and QA Cat-A (based on trimethylamine), showed delayed cream time and rapid rise profiles. As shown in Figure-3, TR20 produced a better density distribution which is associated with the improvement of flowability and moldability in pour-in-place application.

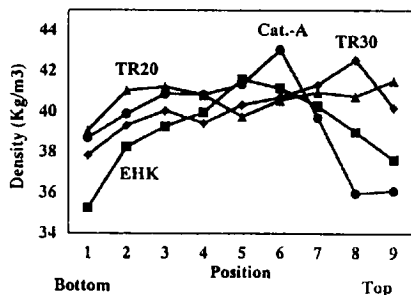


Figure 3 Effect of isocyanurate catalyst on density distribution of PIR foam.

Legend: EHK (square), Cat-A (circle), TR20 (triangle), TR30 (diamond)

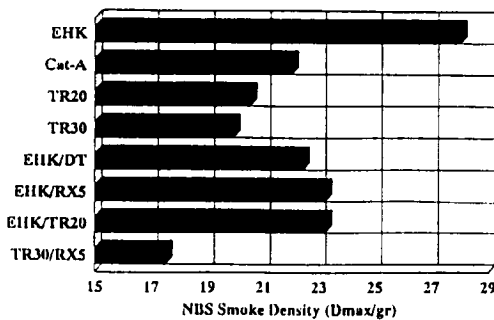


Figure 4 Effect of isocyanurate catalyst on NBS smoke density in 141b/CO₂ PIR foams.

TR series was effective to improve flame resistance such as NBS smoke density as shown in Figure-4, which was due to the formation of carbonized solid residues. Figure-5 shows the conversion of isocyanate and trimer formation measured by FT-IR. TR20 and TR30 exhibited a lower content of unreacted isocyanate on the surface of the foam, namely, which indicates these catalysts have higher catalytic activity at lower temperature.

In the case of Cat-A and EHK, a much large amount of unreacted isocyanate was observed at the surface. Although there was not a significant difference in the content of trimer at the surface among the catalysts, TR30 and EHK/RXS systems provided higher trimer content at the core of the part as shown in Figure-6.

Since the newly developed TR20 and TR30 are odorless and stable at higher temperature during foaming, they can also be applied to other applications such as spray foam as well as polyurethane foam systems where catalyst odor is a problem.

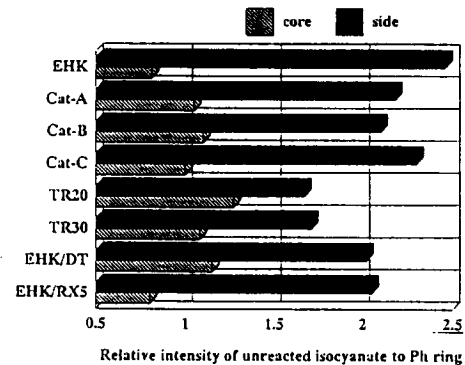


Figure 5 The relative content of unreacted isocyanate in 141b/CO₂ blown PIR foams(FT-IR).

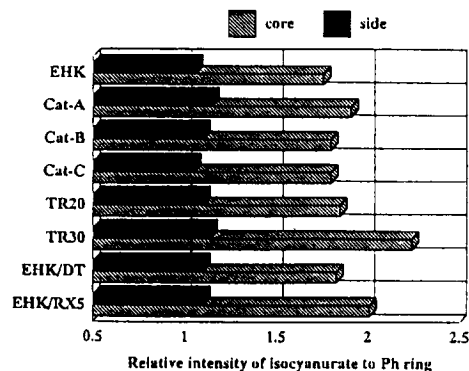


Figure 6 The relative content of isocyanurate linkage in 141b/CO₂ blown PIR foams(FT-IR).

TOPICS IN JAPAN

NEW ALIPHATIC ISOCYANATE

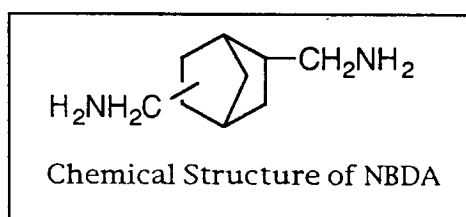
Aliphatic isocyanates, isophorone-diisocyanate (IPDI) and hexamethylene-diisocyanate (HMDI) are well known. IPDI is so far produced only by Huls, but price and capacity are major problems. Today, however, BASF and Degussa have both started construction of new IPDI facilities to cover the expected growing worldwide demand.

In Japan, another new aliphatic isocyanate has been proposed by major Japanese isocyanate and polyol manufacturer "Mitsui Toatsu Chemical". The product is norbornanediisocyanate "NBDI", which is a derivative of norbornanediamine "NBDA". Mitsui has started the production of NBDA with a capacity of 400t/Y primarily for epoxy resin curing agents, which IPDI is also used globally. As developmental stage, Mitsui

decided to begin the marketing of isocyanate derivatives.

Since NBDI has a primary isocyanate group, it is said that its reactivity is similar as HMDI and higher than IPDI. Mitsui states the rigid structure of the norbornane structure of NBDI provided an improvement in the foam physical properties such as heat resistance and strength compared with HMDI having a more linear chain.

Only Mitsui has succeeded to be the first commercial producer of NBDA and NBDI.



INFORMATION

Long range Laser Displacement (LLD) Method for Rise profiles

Tosoh presents a new rise profile measuring system, that it Long range Laser Displacement (LLD) method, in the presentation of newly developed isocyanurate catalysts at SPI 96 in Las Vegas.

Although many methods were so far utilized for measuring rise profiles, each method using ultrasonic waves is convenient to measure as a non-contact method. Ultrasonic waves, however, have been reported to be affected by thermal and chemical effect (Dr. Hofmann et. al., SPI95, p339). Since the LLD method uses a laser, such effect has not appeared.

The advantages of LLD method are as follows;

1. Non-contact.
2. Measuring point on the foam surface is recognizable.
3. Less effect of the heat on foam surface.
4. Less noise on the acquisition data.
5. Enable to measure rise profiles using thin and deep mold for the evaluation of appliance foams as well as pour-in-place applications.

The rise profile is very clear as shown

in Figure-8. The success of LLD method is due to the commercial production of the cheap and long range laser. We are using a laser produced by Kyence which is Japanese measuring equipment maker.

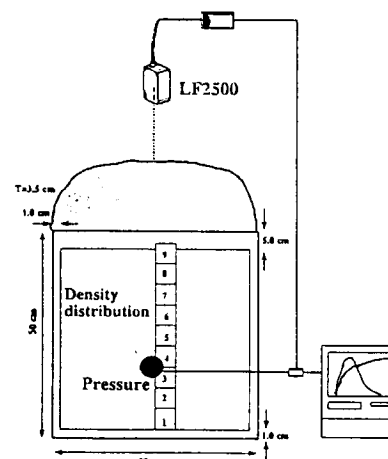


Figure 7 LLD equipment and rise rate measurement system.

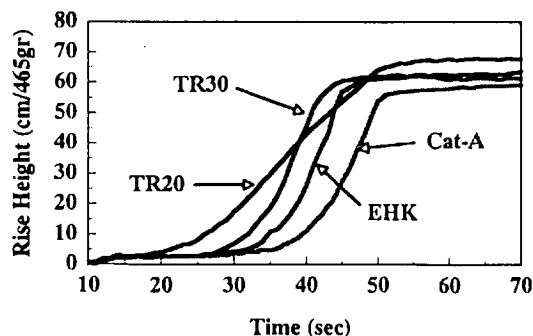


Figure 8 Effect of catalyst on rise profile of PIR foams using LLD rise rate measurement system.