

# TEDA & TOYOCAT NEWS

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It is a great pleasure for us to issue our third issue of the TEDA & TOYOCAT News. We hope it will serve to help you 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 us if there is some other way in which we can be of assistance.

## TOPICS

### TOSOH's STAND & PRESENTATION AT UTECH ASIA '95

UTECH Asia '95, which will be the second UTECH held in Asia, is to be held on coming May 23-25 in Singapore. TOSOH Corporation will have a stand as well as presentation as last UTECH.

Asian, especially East & South-East Asian countries have experienced high economic growth in GDP (Gross Domestic Product) as shown in Table 1. Polyurethane industries have also high growth in the production. For example, automobiles and refrigerators industries are increasing year by year.

The topics of TOSOH's presentations at UTECH Asia are as follows;

#### *Flexible molded foams;*

- lower density & improved cure
  - Toyocat-F2 & F4
- improved surface cure & moldability
  - Toyocat-M50 & D60

Strong gelling activity of Toyocat-F2 & F4 provides a stable foaming behavior in water-rich formulations using a high EO content polyol, thereby produces lower density foams not only in TDI or TDI/MDI based HR foams but also in MDI based HR foams. Non-thermosetiveness in catalytic activity of Toyocat-M50 & D60 causes improved surface cure and moldability even at low mold temperature.

#### *Rigid foams;*

- improved flowability, dimensional stability, & thermal conductivity in 141b & cyclopentane blown
  - Toyocat-TMF

- less expansion (fast cure)
  - Toyocat-F40
- improved friability
  - Toyocat-F94

Toyocat-TMF can work as a nucleation catalyst, therefore provides a finer cell structure to improve k-factor. Since TMF has an extremely strong blowing activity, however, the combination of TMF with Toyocat-MR, NP or DMCH is recommendable. Toyocat-F40 provides less expansion level at demold time, namely improves cure speed. Toyocat-F94 improves surface brittleness or friability in water-rich systems due to its strong gelling activity.

The next UTECH meeting will be held on March 1996 in The Hague, The Netherlands. TOSOH Corporation will also participate and have a stand and presentation.

Table 1. Economic growth rate of GDP in 1994 in Asian countries.

China	11.8 (%)
Korea	8.3
Taiwan	6.5
Hong Kong	5.5
Singapore	10.1
Philippines	4.3
Indonesia	7.4
Thailand	8.5
Malaysia	8.5
Vietnam	8.8
Bangladesh	4.6
India	5.3
Pakistan	4.0
Japan	1.7 ('93:-0.2)

REVIEW OF TEDA & TOYOCAT

**DELAYED ACTION CATALYSTS**

TOSOH has supplied a variety of delayed action tertiary amine catalysts as shown in Table 2, which covers blowing to gelling catalytic activity for many applications.

A typical grade, Toyocat-TF is a delayed action catalyst based on TEDA, which is a strong gelling catalyst. These days, stronger delayed behavior than TF is sometimes requested. For such requirements, Tosoh supplies Toyocat-B41 & F22 which has a stronger gelling activity than TEDA. As seen in Table 3, TF provides a longer CT (Cream Time) compared with TEDA-L33 when GT (Gel Time) is adjusted to the identical time 60 seconds. Moreover B41 & F22 provides the longest CT.

On the other hand, Toyocat-ETF is a delayed action catalyst based on a strong blowing catalyst, Toyocat-ET. Since the content of catalyst in ETF is low, it would be better to increase the blend ratio of ETF compared with the blend case with ET as shown in Table 4.

For many applications, TF and ETF can be used as an alternative catalyst to L33 and ET in order to achieve a longer cream time. Moreover the use of delayed catalyst lead to the increase of amine content. As a result, improved flowability as well as improved cure speed can be obtained.

Specialized delayed action catalyst Toyocat-SPF2, which is a well-balanced catalyst on blowing & gelling activity, provides a longer cream time (cf. Table

4) as well as improved flowability and moldability in HR molded foam systems.

For rigid foam applications, Toyocat-TF & B41 provides improved flowability as well as fast cure speed, for example in a composite panel combined with glass fiber mat.

Table 3. Reaction profiles with delayed action gelling catalysts (Recipe : HR foam).

Catalyst (pbw)	L33	TF	B41	F22
CT (Seconds)	13	15	18	18
GT	60	60	60	60
RT	87	76	90	89

Table 4. Reaction profiles with delayed action catalysts having a blowing catalytic activity (Recipe : HR foam).

Catalyst (pbw)	L33/ET (4/1)	L33/ETF (3/2)	SPF2
CT (Seconds)	7	9	9
GT	80	80	79
RT	115	108	106

Delayed Action Catalyst	Base Catalyst
Stronger in blowing activity ↑	
Toyocat-ETF	---- Toyocat-ET
Toyocat-B54	
Toyocat-B20	
Toyocat-SPF2	
Toyocat-THN	
Toyocat-TF	---- TEDA-L33
Toyocat-F83	
Toyocat-B41	
Toyocat-F22	
↓ Stronger in gelling activity	

TOPICS IN JAPAN

**SHARP APPLIED OPEN CELL FOAM FOR VACUUM INSULATION PANEL**

One Japanese refrigerator manufacturer SHARP has adopted the use of a vacuum insulation panel (VIP) made from an open cell polyurethane foam as an insulation material in their refrigerators. The insulation board is constructed with the VIP and cyclopentane blown polyurethane foam.

As mentioned in the 1st issue of TEDA & TOYOCAT NEWS, the VIP was filled with a silicate in a heat-sealed plastic bag when SHARP first used VIP one year ago. In this spring, however, SHARP changed the silicate powder to an open cell PU foam as the insulation material of the VIP. Since the insulation effect of new VIP has 2.5 times better than conventional PU foam, they said that the wall thickness of refrigerator did not increase and remained the original value (28mm) as the former type utilized the silicate system. Their most popular size is 400 liters in an internal cubic volume.

TECHNICAL VIEW

**Improvement of Cure in Rigid Foams : Characteristics of F40, F94 & B41**

In rigid foam systems, the improvement of the cure speed is frequently requested for high productivity. For improving curing function, there exists two factors, that is, the improvement of expansion level as well as hardness of foam surface at demolding time. Therefore one should consider which factor is concerned with one's requests. For these two factors, Tosoh has developed many new tertiary amine catalyst systems.

In order to reduce expansion level at demold time, one may think a blowing catalyst such as Toyocat-ET and DT improves expansion level due to the decrease of foaming pressure by blowing activity. Expansion level using a blowing catalyst, however, is not improved up to one's expectations, especially when the overpacking ratio is higher than 100%, since the blowing catalyst has a tendency to provide a relatively weak foam strength.

Tosoh has developed a new tertiary amine catalyst Toyocat-F40 which can increase the foam strength even though F40 has a strong blowing activity. As seen in Figure 1, F40 provided the lowest expansion level in HCFC-141b blown rigid foam systems (also effective in cyclopentane blown systems). The combination with DMCHA and MR, which are used as a conventional base catalyst, also provided less expansion level. Moreover, since F40 has a strong blowing activity, F40 can be used in exchange for a conventional blowing catalyst such as ET and DT. That is to say, the combination of DMCHA/F40 and MR/F40 is recommendable for rigid foam systems in place of DMCHA/DT and MR/DT when less expansion is requested.

On the other hand, the hardness of the

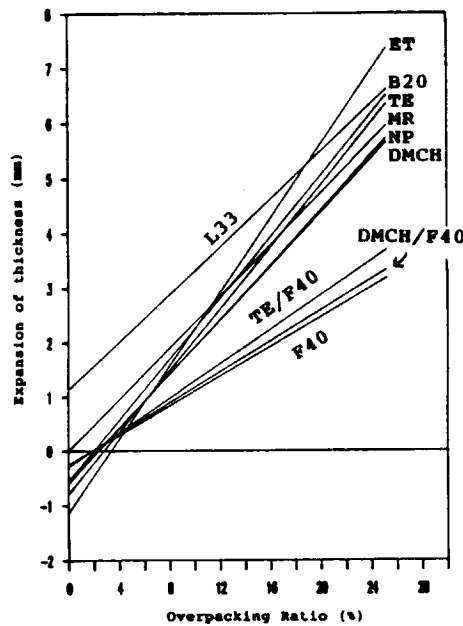
foam surface is important in order to improve cure speed, for example, in the production of synthetic wood as well as the continuous sandwich panel. Tosoh's specialized catalyst Toyocat-F94 improves especially surface hardness as shown in Figure 2, at an early reaction stage than every other catalysts due to its extremely strong gelling activity.

In the continuous sandwich panel, fast cure speed is also important especially when the foam thickness is thin or the length of line is short. It may be one resolution to increase the amine catalyst amount in order to fasten cure speed. In some times, however, too short cream time have to be avoided for adjusting the rise profile to the position of the first press roller. In such case, strong gelling catalyst

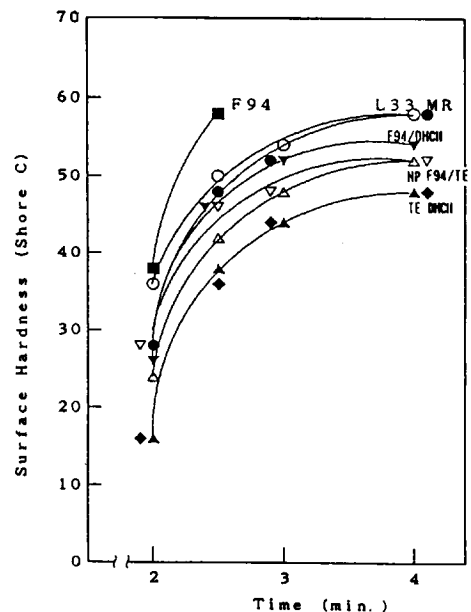
Toyocat-B41 provides a longer cream time as well as improved cure speed (Table 5). The effect of B41 becomes more distinct when the line temperature is relatively high like 60°C.

**Table 5. Reaction Profiles & Cure Speed with Toyocat-B41.**

Catalyst (pbw)	0.7	0.4	
TEDA-L33	0.7	0.4	
DMCHA	0.2	-	
Toyocat-B41	-	0.9	1.53
<b>Reaction Times</b>			
CT(seconds)	13	13	14
GT	41	39	41
RT	65	61	64
Core Density (kg/m <sup>3</sup> )	30.4	30.0	29.5
<b>Cure/Hardness(Shore C)</b>			
1.5 min.	11	24	25
2.0	32	42	43
2.5	45	51	52
3.0	52	56	57



**Figure 1. Expansion level at demolding with changing packing ratio (141b blown).**



**Figure 2. Built-up profile of surface hardness on top of free risen foam (H<sub>2</sub>O blown).**

<b>TEDA &amp; TOYOCAT® APPLICATION GUIDE</b>
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<b>GENERAL</b>
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Gelling Catalyst (L33)	Long Cream Time	TF
Blowing Catalyst (ET)	Long Cream Time	ETF
	Cost Saving	DT

<b>FLEXIBLE FOAM</b>
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Slabstock	Fast Cure Odorless	M50/ET L33/D60
Hot Cure	CFC-free (high air-flow, low density)	L33/F2 (or F4)
TDI based HR (TDI/MDI)	Moldability (long cream time) Moldability (at low mold temp.) Odorless, Fast Cure, Moldability Anti-fogging Low Density, Moldability	SPF2, B41/DT M50, L33/D60/ET L33/D60/ET HX63 L33/ET/F2 (or F4)
all-MDI based HR	Odorless, Fast Cure, Moldability Moldability, Fast Cure Low Density, Moldability	L33/D60/ET SPF2, M50 L33/ET/F2 (or F4)

<b>SEMI-RIGID FOAM/OTHERS</b>
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Headrest, Armrest	Moldability, Substitute for TEA	M50
Instrument Panel	Anti-Vinyl Stain, Moldability	HX63/ET, HX70/ET
Composite Panel	Flowability, Fast Cure	TF, B41
Packaging	Anti-Fogging	RX5
ISF (CFC-free)	Skin Formation Flowability, Fast Cure, Moldability	F22/L33, F22/M50 F2/ETF, L33/ETF

<b>RIGID FOAM</b>
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Cyclopentane Blown	Dimensional Stability, k-Factor Flowability, Dimen.Stability, k-Factor	NP NP(or MR, DMCH)/TMF
HCFC-141b Blown	Flowability, Dimen.Stability, k-Factor Low Expansion at Demold (Fast cure)	NP(or MR, DMCH)/TMF DMCH/F40
Water Blown	Friability Dimensional Stability	F94 MR(or DMCH, TE)/DT
Sprayed Foam	Optimized Package Improve Adhesive Strength	B2, B71 B2(or B71)/F94
Isocyanurate Foam	Smooth profile	TRC/K-Octoate

<b>ELASTOMER</b>
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Shoe Sole	Fast Cure Low Density (CFC-free), Flowability	L33E/B41, L33E/F2 L33E/M50, L33E/NP
Elastomer	Delayed action, Flowability, Fast Cure Long Pot Life	L33/TF, L33/F22 F22

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