MITSUI CHEMICALS,INC.

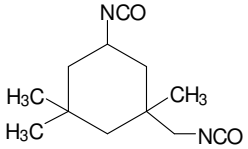
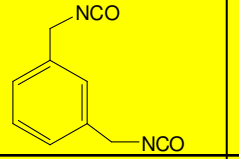
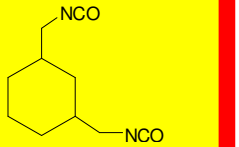
High Performance Specialty Isocyanate

TAKENATE™

ver. 2.0

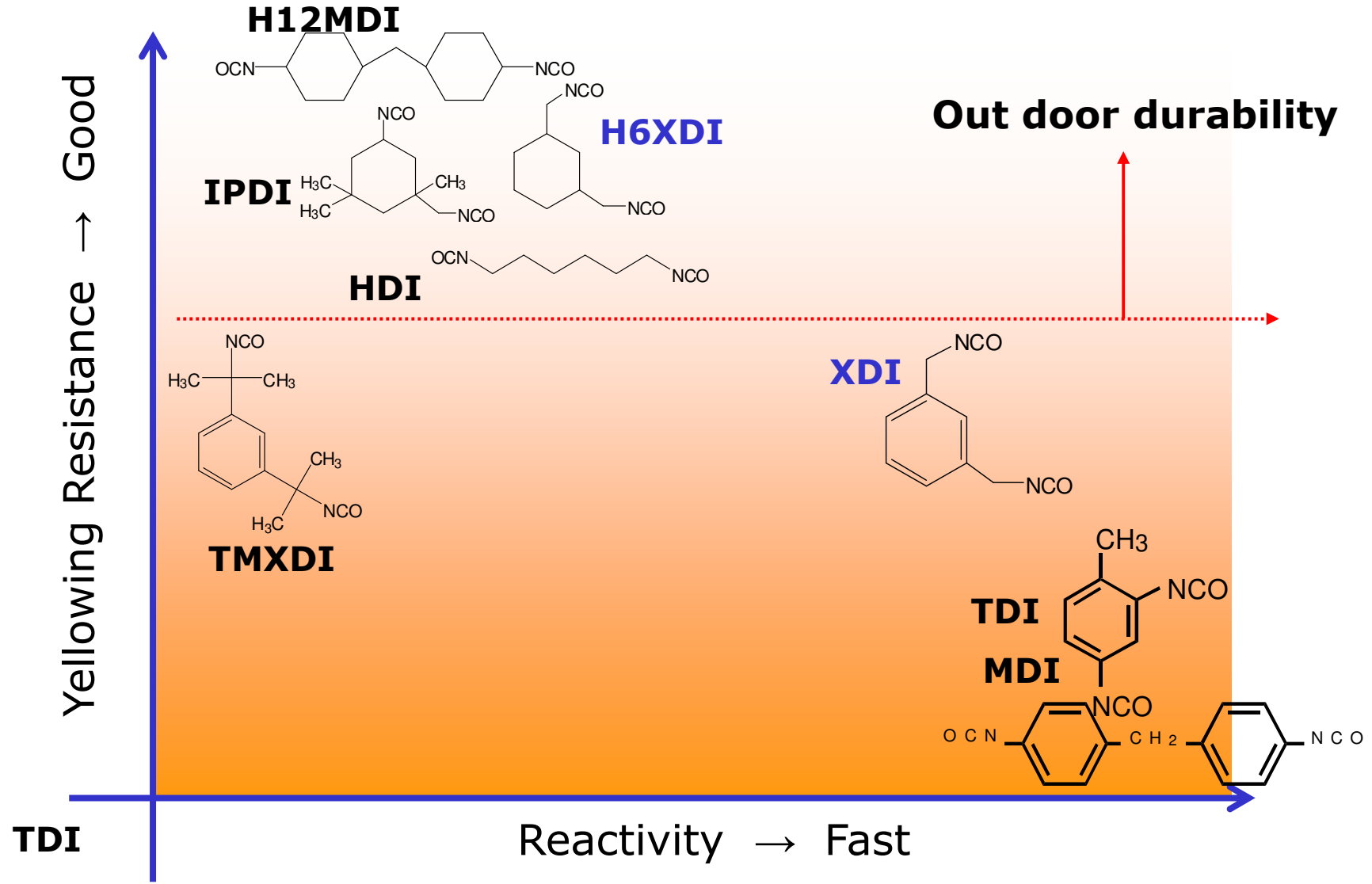
TAKENATE™ 500 (Xylylene Diisocyanate: XDI)
TAKENATE™ 600 (Hydrogenated XDI:H6XDI)
TAKENATE™ D-110N (XDI-TMP adduct)
TAKENATE™ D-131N (XDI-Trimer)New
TAKENATE™ D-120N (H6XDI-TMP adduct)

Specialty Isocyanates of Mitsui and Their applications

Isocyanates		HDI	IPDI	H12MDI	XDI	1,3-H6XDI
						
TAKENATE™	Diisocyanate	700	-	-	500	600
	TMP adduct	D-160N	D-140N	-	D-110N	D-120N
	Trimer	D-170N	-	-	D-131N New	-
	Biuret	D-165N	-	-	-	-
Application*	Coating& Ink					
	Adhesive					
	Sealant					
	Elastomer					
Remarks					XDI Trimer (D-131N) and 1,3-H6XDI TMP Adduct (D-120N) are Mitsui Original	

* ■ ···Very Suitable, ■ ···Suitable

Comparison of Yellowing and Reactivity



Mitsui Original Specialty isocyanates

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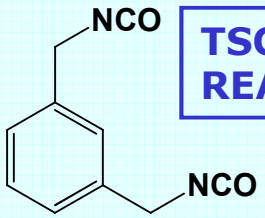
【TAKENATE™ 500】

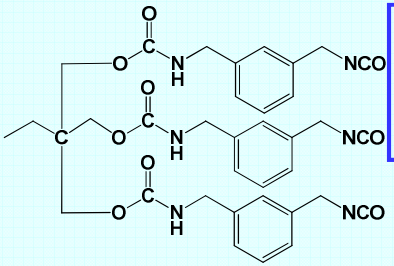
XDI monomer



TSCA listed
REACH registered

【TAKENATE™ D-110N】

XDI-TMP adduct (Solvent borne)

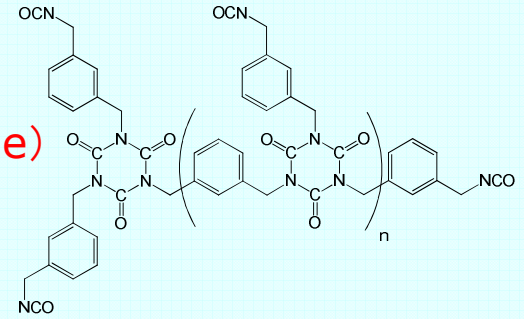


TSCA listed
REACH Pre-registered products
(Applying for registration)

New

【TAKENATE™ D-131N】

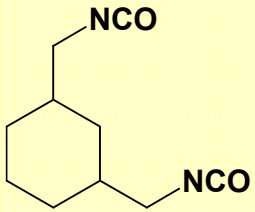
XDI-Trimer (Solvent borne)



TSCA / REACH
Planning to apply for registration

【TAKENATE™ 600】

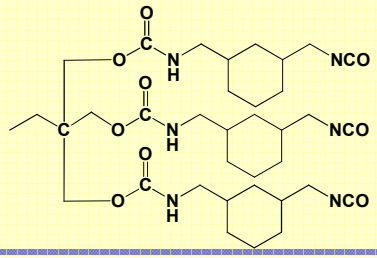
H6XDI monomer



TSCA listed
REACH Pre-registered products
(Applying for registration)

【TAKENATE™ D-120N】

H6XDI-TMP adduct (Solvent borne)



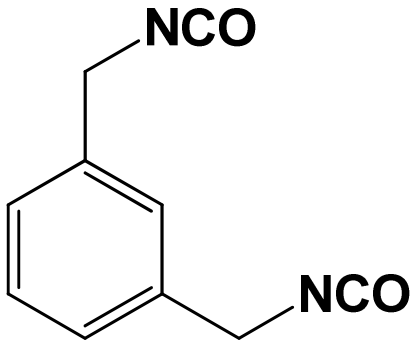
TSCA listed
REACH Pre-registered products
(Applying for registration)

Mitsui Original Specialty isocyanates

MITSUI CHEMICALS,INC.

【TAKENATE™ 500】

XDI monomer

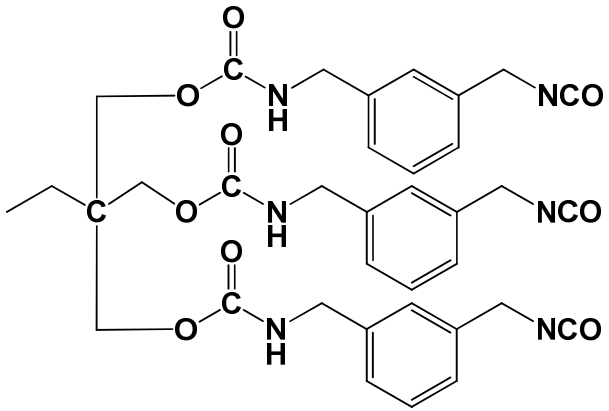


REACH Registered
TSCA listed

Modification,
Separation & Refining

【TAKENATE™ D-110N】

XDI-TMP adduct (Solvent borne)



Contained 25% Ethyl Acetate

REACH Pre-registered products
TSCA listed

SPECIFICATIONS

Appearance:	Pale yellow, clear liquid
Color number, Gardner:	1 Max.
Solid content, %:	75.0± 1.0
Viscosity at 25°C, mPa·s:	500 ± 400
NCO content, %:	11.5 ± 0.5
Free XDI monomer, %:	0.5 Max.(Average 0.3%)

Regulation for Food Packaging of D-110N(NB)

- EU. Commission Regulation No 10/2011

on Plastic Materials and Articles Intended to Come into Contact with Food, as amended by Regulation 1183/2012/EU, OJ (L338) 11, 12 December 2012

- FDA

§177.1390;
"Laminate structures for use at temperatures of 250°F(120℃) and above"
(c)(2)(iv)(b), (c)(2)(vi)(b), and (c)(2)(vii)(b)

§177.1395
"Laminate structures for use at temperatures between 120°F (48℃) and 250°F(120℃) "

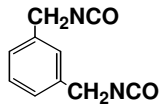
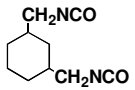
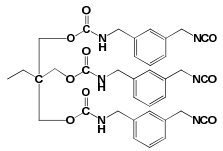
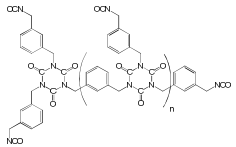
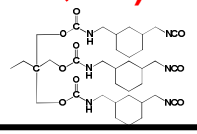
TAKENATE ™ D-110N : For General Industrial Grade

TAKENATE ™ D-110N(NB) : For Food Packaging Grade

Component		CAS No. / EC No.	TAKENATE™	
			D-110N	D-110N(NB)
Composition	Urethane Resin	Proprietary / -	74%	74%
	Ethyl Acetate	141-78-6 / 205-500-4	25%	25%
	1,3Bis(isocyanatmethyl) Benzene (XDI)	3634-83-1 / 222-852-4	0.3%	0.3%
	2,6-Di-tert-butyl-p-cresol (BHT)	128-37-0 / 204-881-4	0.3%	(2.3ppm)

Summary of Characteristics and Application

MITSUI CHEMICALS,INC.

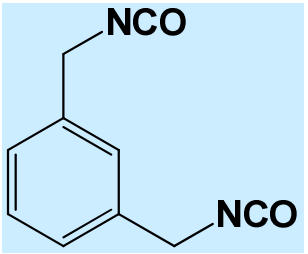
	TAKENATE™	Characteristics	Application (example)
Monomers	500 	- Better yellowing resist (Than TDI, MDI) - Much faster reactivity（Than HDI, IPDI) - High reflective index	Raw materials for synthesis of the resins for various CASE raw materials -For PUD and UV synthesis -For Synthetic leather synthesis -For outdoor sealant
	600 	- Excellent yellowing resistance (Same as HDI) - Hardness（Than HDI) - Reactivity (Than IPDI)	
Derivatives	D-110N（S/B） 	- High adhesive strength - High Stain resistance - High reactivity - Low yellowing property	2K Curatives for Coatings, INKS applications - Information & Electronics appliances - Automotive interior - Curatives for inks
	D-131N（S/B） 	- Quick Dry (Than D-110N) - Good Heat resistance (Than D-110N) - Less Yellowing (Than D-110N) - Longer pot life (Than D-110N)	
	D-120N（S/B） 	- Excellent weatehrability - Higher heat resistance, hardness （than HDI trimer)	- Back sheet film for solar cell - Automotive exterior - Out door sealant (9

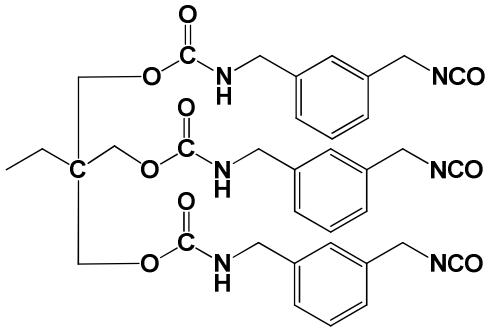
Competitive performance of Xylylene diisocyanate

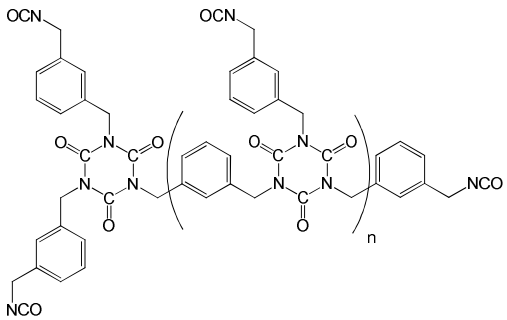
Benefits from【TAKENATE™ 500】[1] (XDI) aliphatic isocyanate and 【TAKENATE™ D-110N】(XDI) aliphatic isocyanate adduct polyisocyanates 【TAKENATE™ D-131N】(XDI) aliphatic isocyanate trimer polyisocyanates	
○Manufacturing Advantages	**・Higher Production efficiency(Than HDI, IPDI)**
○Performance Advantages	**・Better yellowing resistance (Than TDI, MDI)**
	・Superior adhesion to a wide variety substrates
	・Heat Resistance
	・High reflective index
	・Higher gas barrier
○Improved Industrial Hygiene	**・In USA, FDA sanction for use in food packaging adhesives under Non-Food Contact (T-500, D-110N)**

1; As used herein, all references to XDI are understood to be TAKENATE™ 500

【TAKENATE™ 500】【TAKENATE™ D-110N】【TAKENATE™ D-131N】







Applications of XDI (XDI and D-110N, D-131N)

MITSUI CHEMICALS,INC.

Main Applications（Ⅰ~Ⅲ）

Ⅰ.Coatings

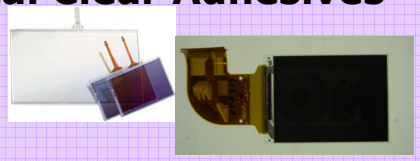
・Automotive interior parts

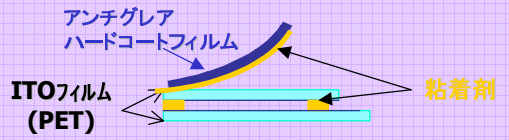
・High performance coatings for Electric / Information appliances body

・Non yellowing Wood coatings

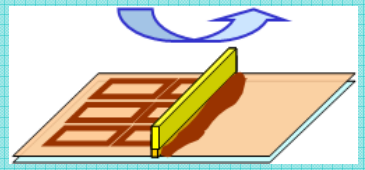
Ⅲ.Adhesives

Curatives for Optical Clear Adhesives

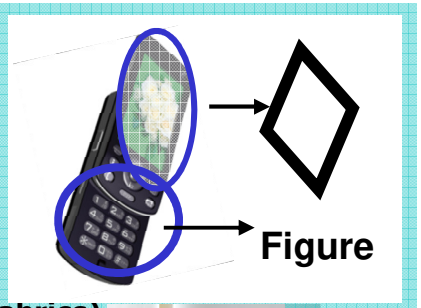




Ⅱ.Inks



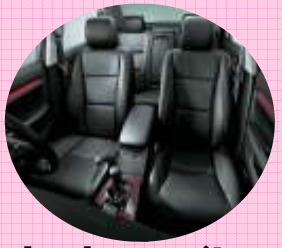
・Silk screen inks
(especially for plastics/fabrics)



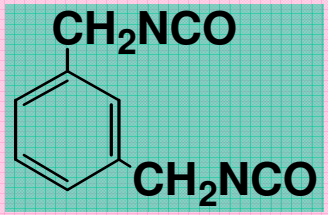
・Gravure inks (Surface printing)
(for Package films/Laminated sheets)

Other applications

・UV resin synthesis
・PUD synthesis
・Resin modification
・Non yellowing sealant



・Optical use(Lense)

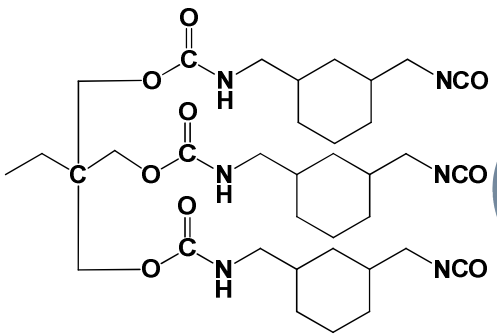


Competitive performance of hydrogenated XDI (H6XDI)

Benefits from【TAKENATE™ 600】[1] (H6XDI) aliphatic isocyanate	
○Manufacturing Advantages	・Compatibility with various polyols
	・Higher Production efficiency (than IPDI)
○Performance Advantages	・Excellent yellowing resistance
	・Hardness, Heat resistance, Toughness (than HDI)

1; As used herein, all references to H6XDI are understood to be TAKENATE™600

【TAKENATE™ D-120N】



Coatings

・Automotive refinish

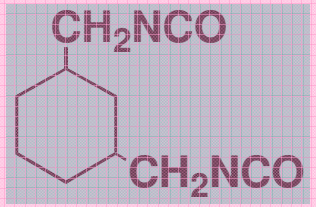
Other applications

・Out door sealant

・Optical use (Lenses)

・Urethane elastomers
【Takenate™ 600】

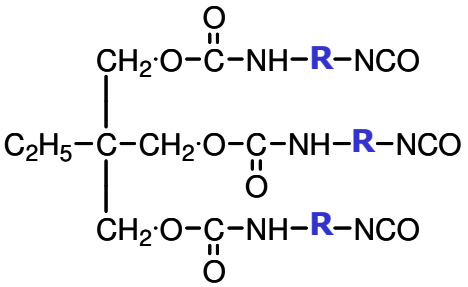
・UV resin synthesis
・PUD synthesis
・Resin modification



Competitive performance of IPDI-TMP Adduct

Benefits from【TAKENATE™ D-140N】Aliphatic isocyanate adduct polyisocyanate	
○Manufacturing Advantages	・Higher Production efficiency (than IPDI or HDI trimer)
○Performance Advantages	・Excellent yellowing resistance
	・Hardness, Heat resistance, Toughness (than HDI)

Main applications



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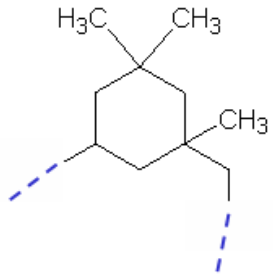


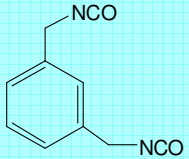
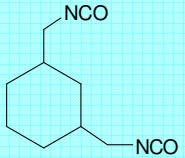
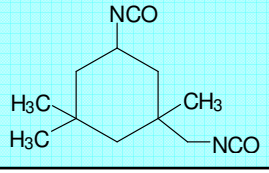
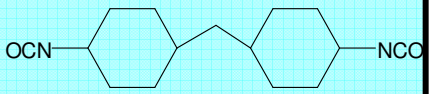
Coatings ・Automotive refinish

Possibility of the coating system
Olester™ Q/Takenate™ D-140N or D-120N

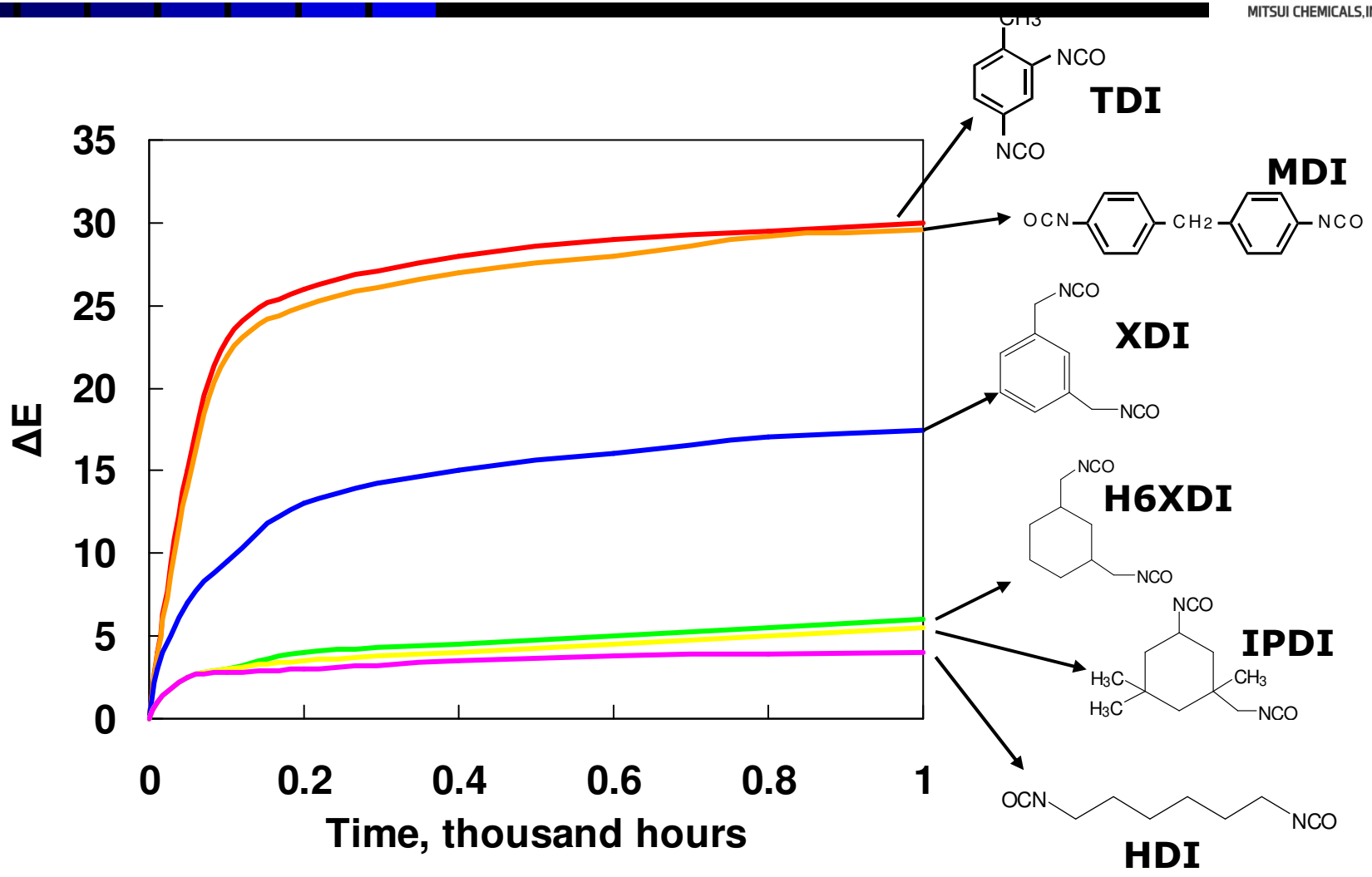
INKS ・Thermal resistance INK application
IMD (In Mold Decoration)

Specifications and Physical Properties

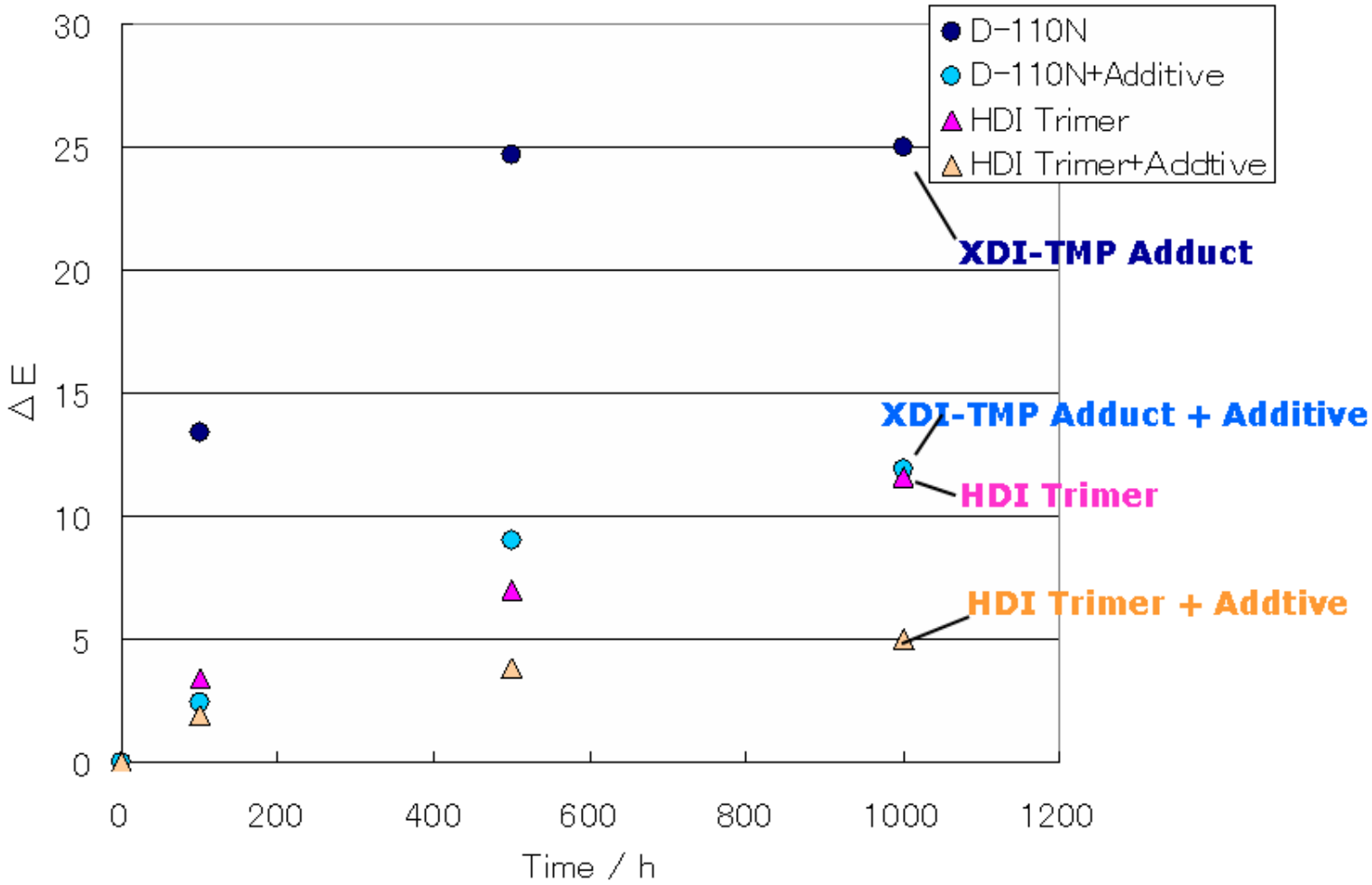
MITSUI CHEMICALS,INC.

Items		TAKENATE™ 500	TAKENATE™ 600	IPDI (Perstop)	H12MDI (Evonik)
					
Specifications					
Appearance		Clear Liquid		Clear Liquid	Clear Liquid
Color, AHPA	HAZEN	100>	20>	30≧	30≧
NCO%	%	44.7	43.3	37.5-37.8	31.8-31.2
Assay	%	>99.0	>99.5	>99.5	≧99.5
Hydrasable Chlorine	%	< 0.5	< 0.1	< 0.02	≦0.001
Physical properties					
Molecular Formula		$C_{10}H_8N_2O_2$	$C_{10}H_{14}N_2O_2$	$C_{12}H_{18}N_2O_2$	$C_{15}H_{22}N_2O_2$
Molecular Weight		188.2	194.2	222.3	262.4
Viscosity	mPa.s	3.3 (at 25℃)	5.8 (at 25℃)	15 (at 20℃)	35 (at 23℃)
Refluctive idex	(n_D^{25})	1.540	1.483	1.483	1.496

Appendix;Weatherability data;QUV UVB* ΔE



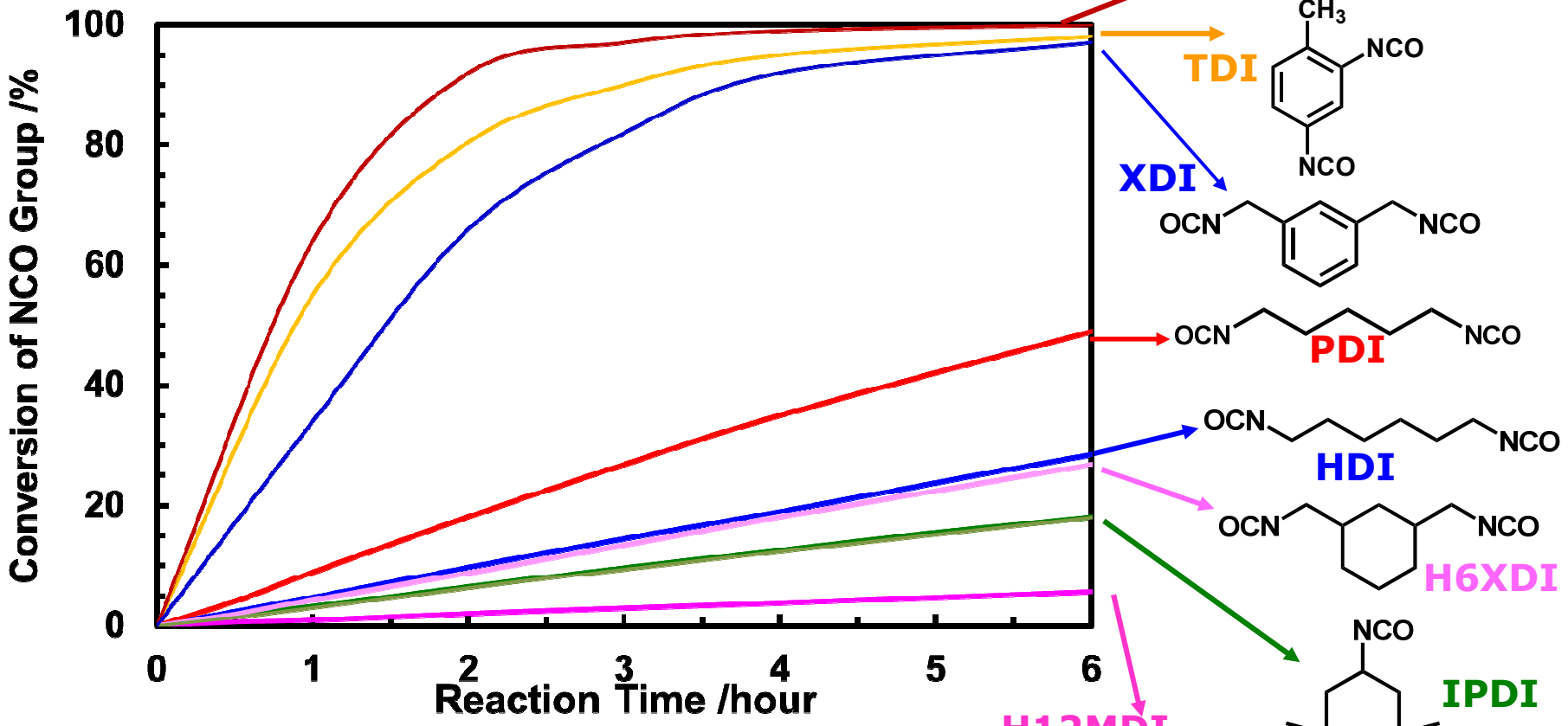
Appendix; Weatherability data; QUV UVB* ΔE



* **Acrylic Polyol ;** Takenate® **UA-999-60X (Non styrene type acrylic polyol)**
* **Additive ; Benzotriazole type(0.5%) + HALS(0.5%)**

Appendix; Reactivity of Diisocyanates Monomer(with 1-Butanol)

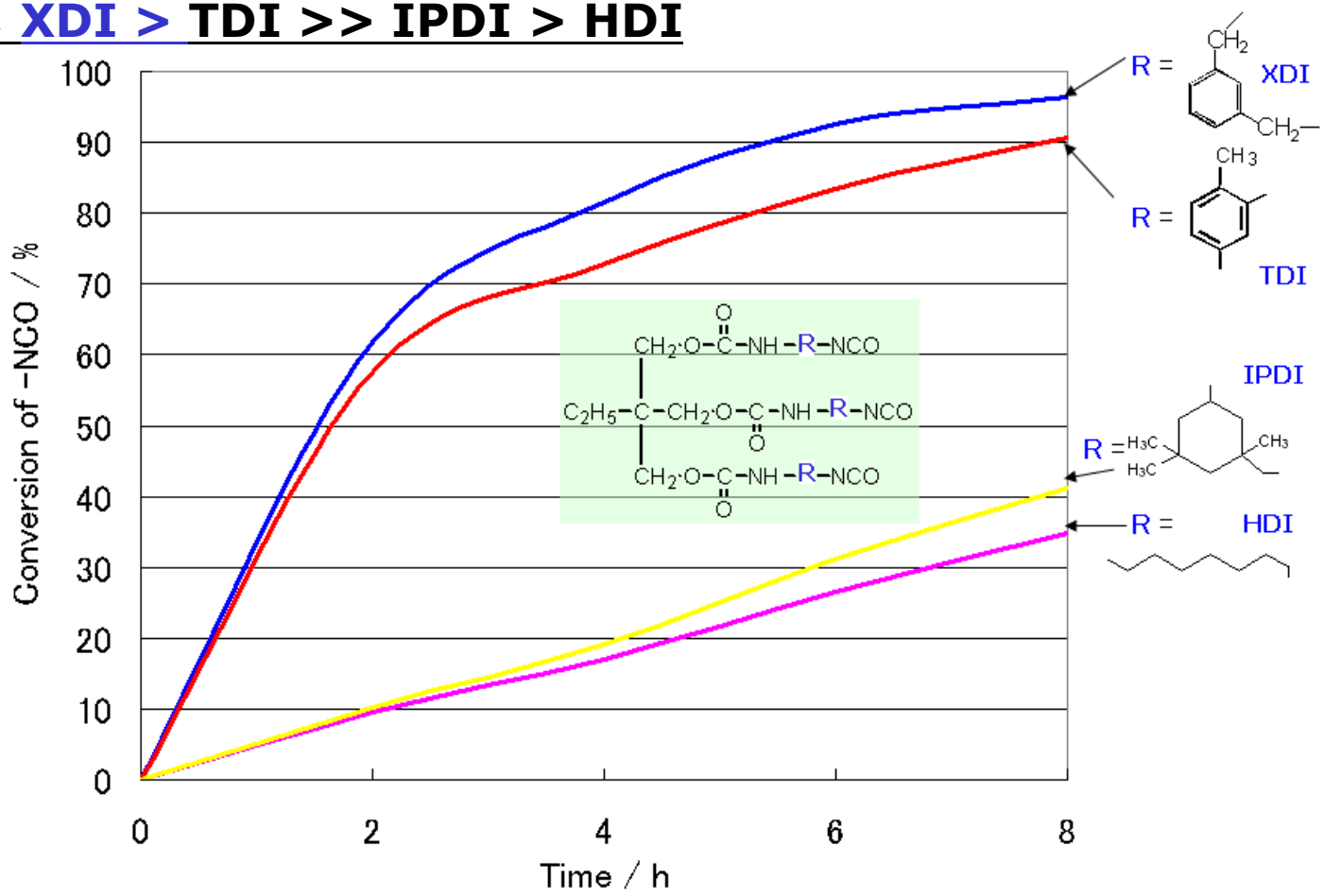
Reactivity; MDI > TDI > XDI >> PDI > HDI> H6XDI>IPDI>H12MDI



Mixing ratio: [NCO]/[OH](n-butanol)=1/4(mole/mole)
Solvent: Toluene Reaction Temperature: 60°C

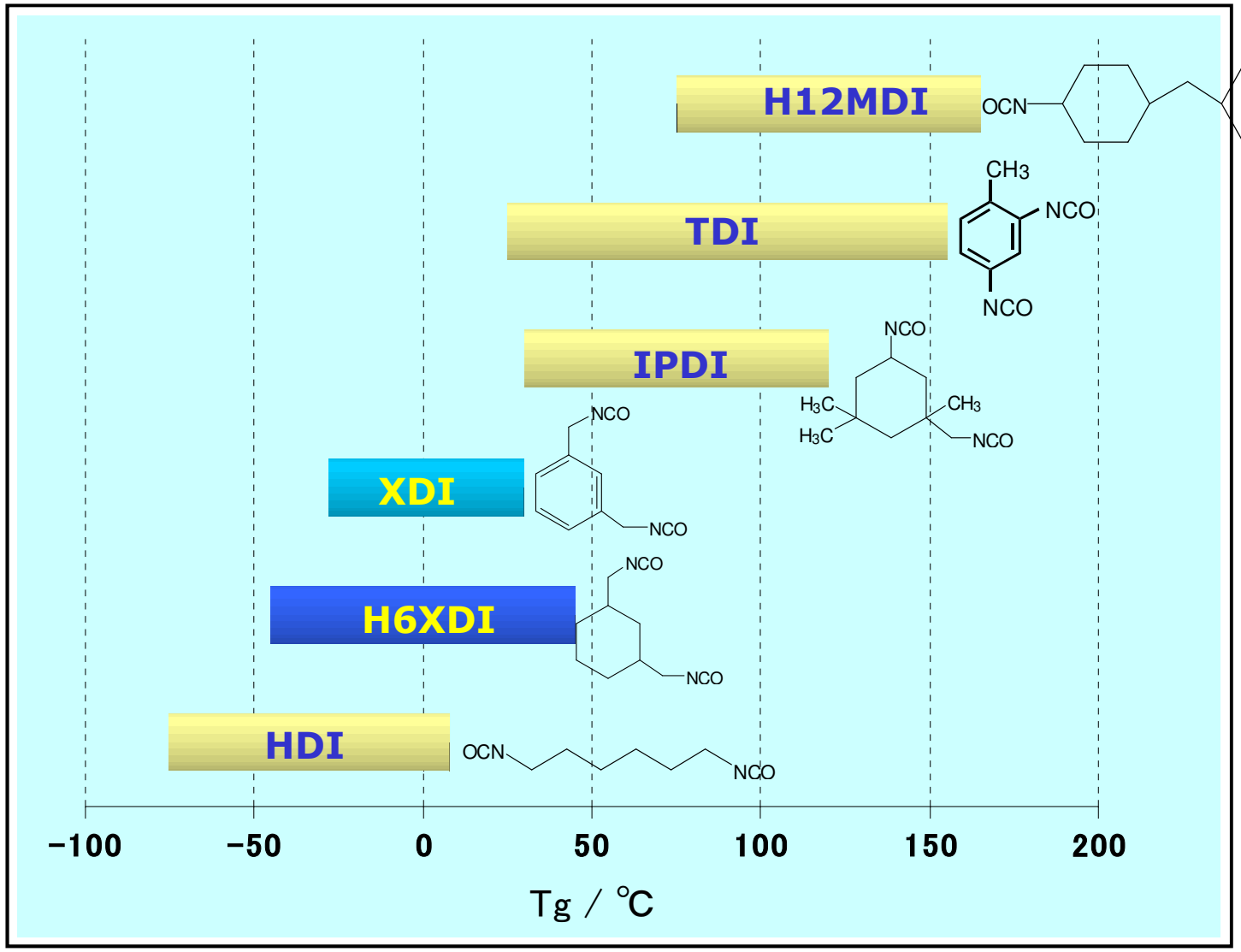
Appendix;Reactivity as Adduct polymer (with 1-Butanol)

Reactive; XDI > TDI >> IPDI > HDI



Mixing ratio:	**-NCO/-OH(n-butanol)=1/2(mole/mole)**
Solvent:	**Toluene**
Temperature:	**25℃ const**

Appendix ; Tg range of various isocyanate derivatives



The Characteristic of the deliveries

MITSUI CHEMICALS,INC.

Mitsui Chemical Grade			Takenate®							
							D-110N	D-131N	D-120N	D-140N
Isocyanate			HDI				XDI	XDI	H6XDI	IPDI
Structure			TMP Adduct	Biuret	Trimer	Allophanate	TMP Adduct	Trimer	TMP Adduct	TMP Aduct
Solution	NCO%	%	12.6 (16.8)	23.3	20.7	19.2	11.5 (15.3)	14.0 (18.7)	11.0 (14.7)	10.5 (14.0)
	NV	%	75	100	100	100	75	75	75	75
	Viscosity	mPa.s	260	2300	2000	120	500	340	2000	2500
	Color	GH	<1	<1	<1	<1	<1	<1	<1	<1
Solvent			EA	—	—	—	Ethyl Acetate (=EA)			
Cured Membrane	Curing Time	hr	3.1	9	8	14	2.4	3.0	2.2＊	0.15＊
	Pot life	hr	24	24	24	36	8	10	5	6.3
	Erichsen	mm	8	8	8	8	8	-	8	2
	Du Pont Impact (1/2inch1kg)	cm	50	50	50	50	100	-	30	10
	Pencil Hardness	—	F-H	F-H	F-H	HB	H	H	H	2H

＊with Catalyst

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■MITSUI CHEMICALS, INC.
Coating & Engineering Materials Division
1-5-2, Higashi-Shimbashi, Minato-ku, Tokyo 105-7117, Japan
TEL:+81-3-6253-4157
FAX:+81-3-6253-4271