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NEW DEVELOPMENTS IN CATALYSIS

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MARKET PLACE

DRIVING FACTORS

ENVIRONMENTAL REGULATIONS
SAFETY- HEALTH
ENERGY

DELAYING FACTORS

REGULATIONS
FRAGMENTATION OF MARKETS
UNCERTAINTY IN MARKET PLACE

COATING TECHNOLOGIES

HIGH SOLIDS - SOLVENT FREE

VISCOSITY/SOLIDS & POTLIFE/DRY TIME

WATERBORNE

COSOLVENT, APPLICATION CONDITIONS

ELECTROCOATING

DRY-TIME

PRODUCTION VOLUME, SUBSTRATE

CURE TEMPERATURE

UV/EB COATING

COMPLEX OBJECTS, PIGMENTS

POWDER COATING

LOW FILM THICKNESS, CURE TEMPERATURE

FLOW AND LEVELING

CONDENSATION REACTIONS

Amino resins, melamine, urea formaldehyde

FORMALDEHYDE, ALCOHOL, WATER

Blocked isocyanate

KETOXIME, PYRAZOL, ALCOHOL

Silane, siloxane

ALCOHOL

Hydroxyethyl amide -carboxyl

WATER

Methylol amide, glycoluril, cyclic urea

WATER

Hydroxyl-carboxyl

WATER

Ring Opening and Addition Reaction

Isocyanate, Uretdione, Carbodiimide

Cyclic acylurea

Epoxy, Glycidyl, Cycloaliphatic, Oxetane

Cyclic Carbonate

2-Oxazoline

Aziridine

Michael Addition

Azlactone

CATALYST NEEDS

ISOCYANATE
WATERBORNE 2K

POTLIFE-REACTIVITY
WATER REACTION

BLOCKED ISOCYANATE
URETDIONE

CURE TEMPERATURE

EPOXY

Yellowing, Reactivity

HYBRID SYSTEMS

MELAMINE
BLOCKED ISOCYANATE
ISOCYANATE
SILOXANE

CATALYSTS FOR ISOCYANATE SYSTEMS

REQUIREMENTS

ORGANOTIN FREE

CATALYSE NCO – OH

POTLIFE – REACTIVITY

NO SIDE REACTION WATER REACTION

WATER REACTION

EXTERIOR DURABILITY

SCREENING OF CATALYSTS

APPLICATION TESTS FORMULATION

POTLIFE (2X VISC.)

GEL TIME

TACK FREE

DRY-THROUGH

MODEL SYSTEMS (ANALYTICAL)

DISAPPEARANCE OF NCO

FORMATION OF URETHANE / UREA

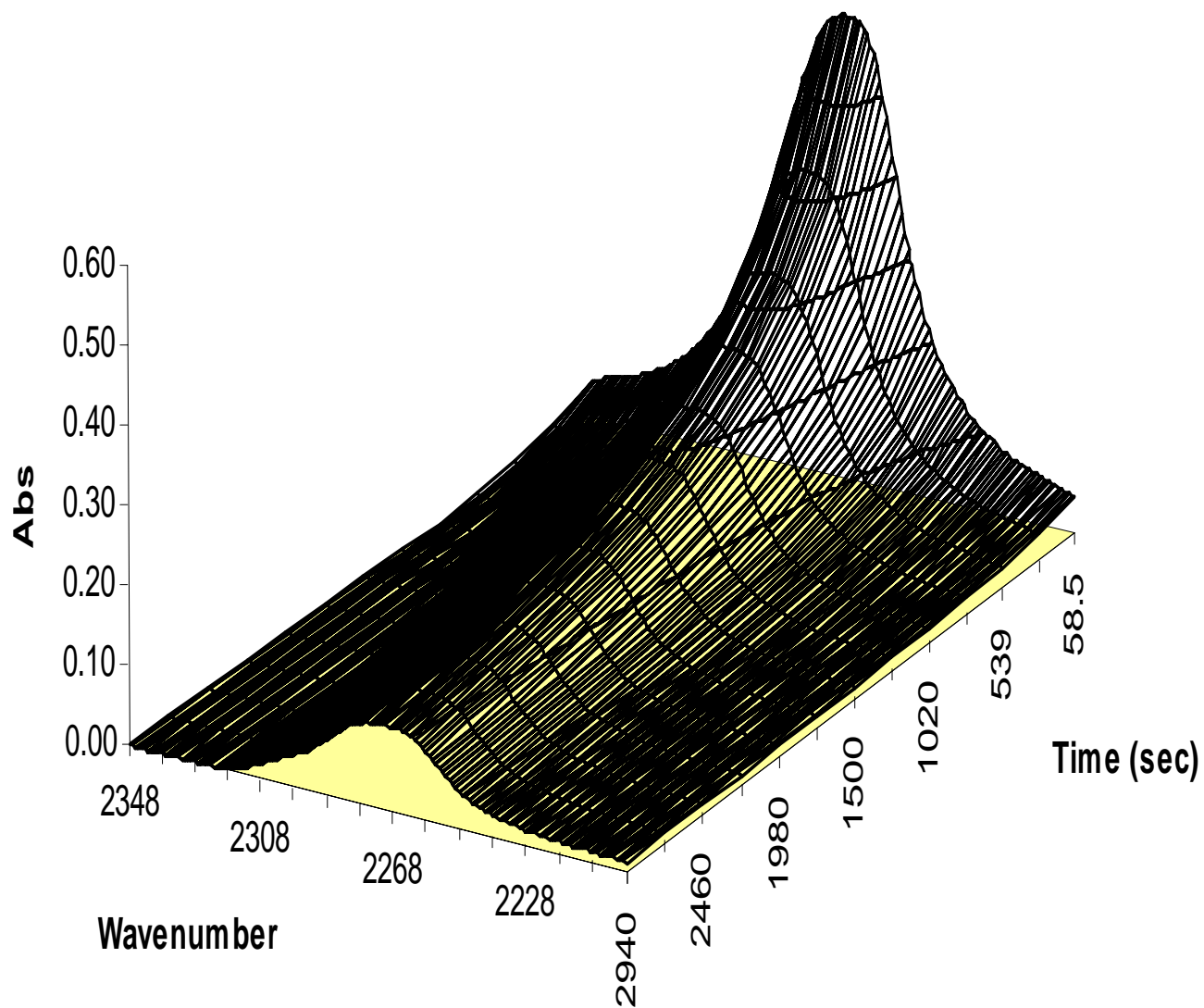
MW

Periodic Table

	1A													8A				
1	1 H	2A	Catalyst for NCO					Not a Catalyst					3A	4A	5A	6A	7A	2 He
2	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
3	11 Na	12 Mg	3B	4B	5B	6B	7B	-----	8B		1B	2B	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
6	55 Cs	56 Ba	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra	89 Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt									

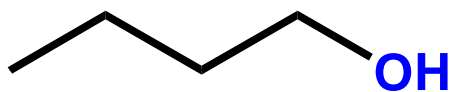
6	Lanthanides	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
7	Actinides	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

Isocyanate Peak Decay

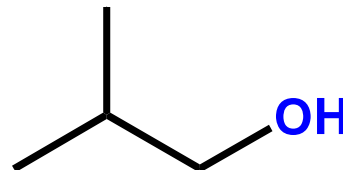


FUNCTIONAL GROUPS USED

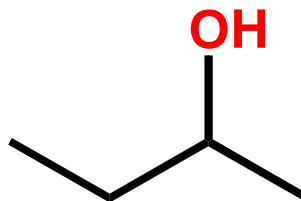
■ n-Butanol



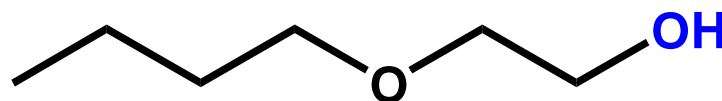
■ Isobutanol



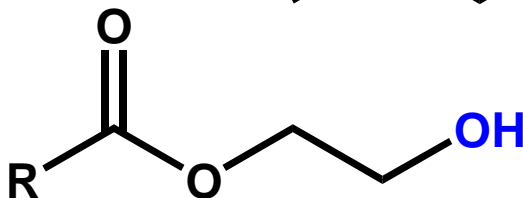
■ 2-Butanol



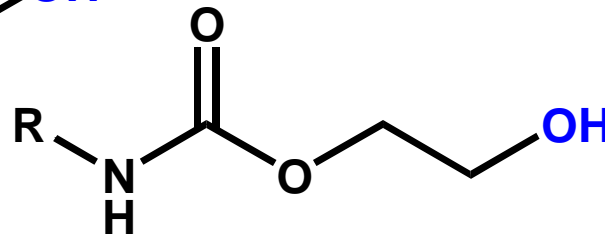
■ 2-Butoxyethanol



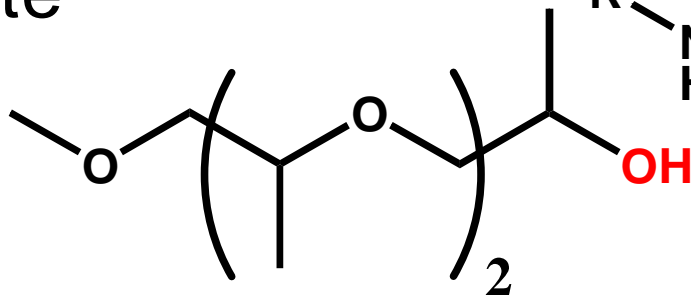
■ HE Ester



■ HE Carbamate



■ TPM



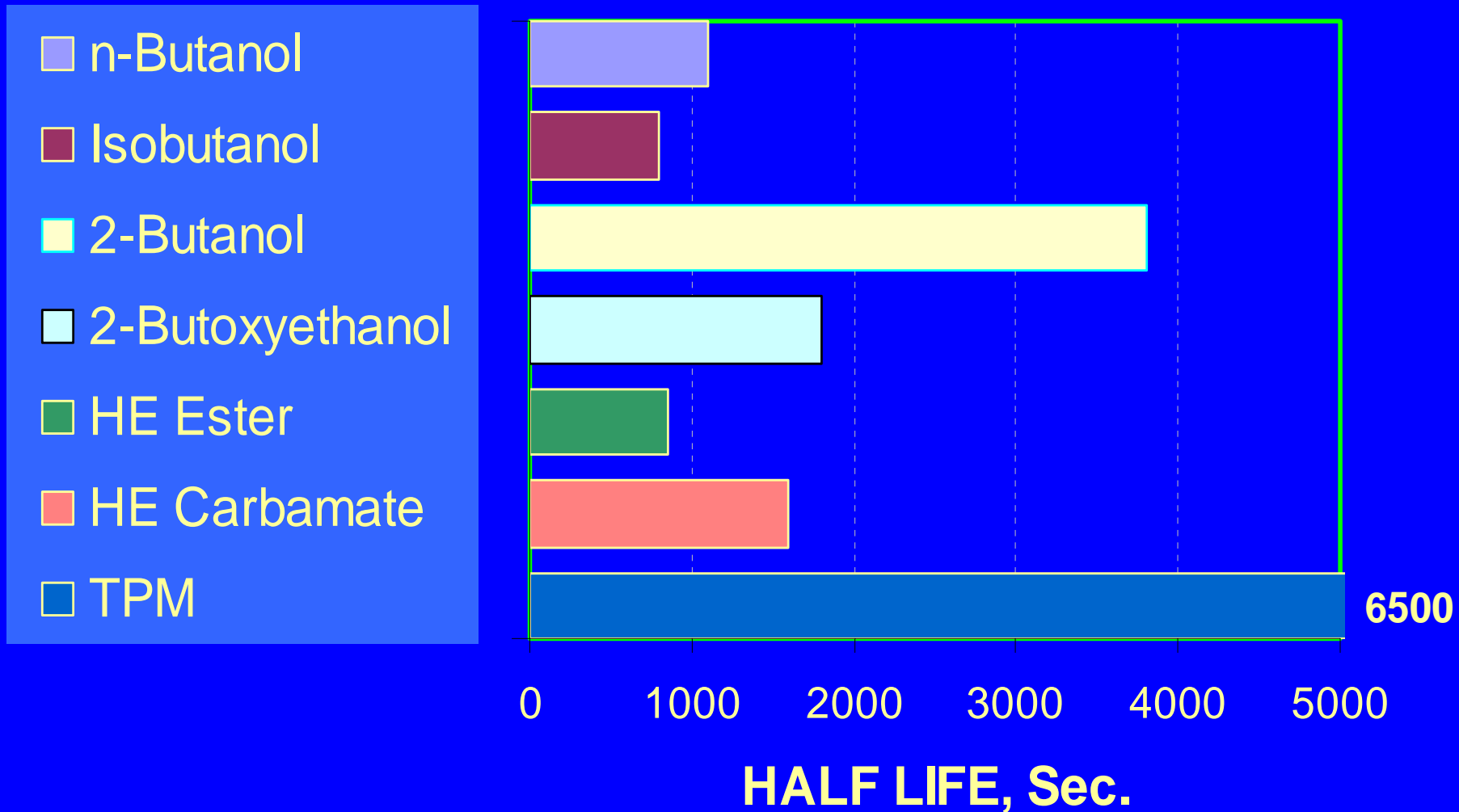
CATALYSTS USED

Dibutyltin dilaurate	DBTDL
Zr dionate complex	Zr Chelate
Bi 2-ethylhexanoate	Bi Carboxyl
Zn 2-ethylhexanoate	Zn Carboxyl

Reaction conditions

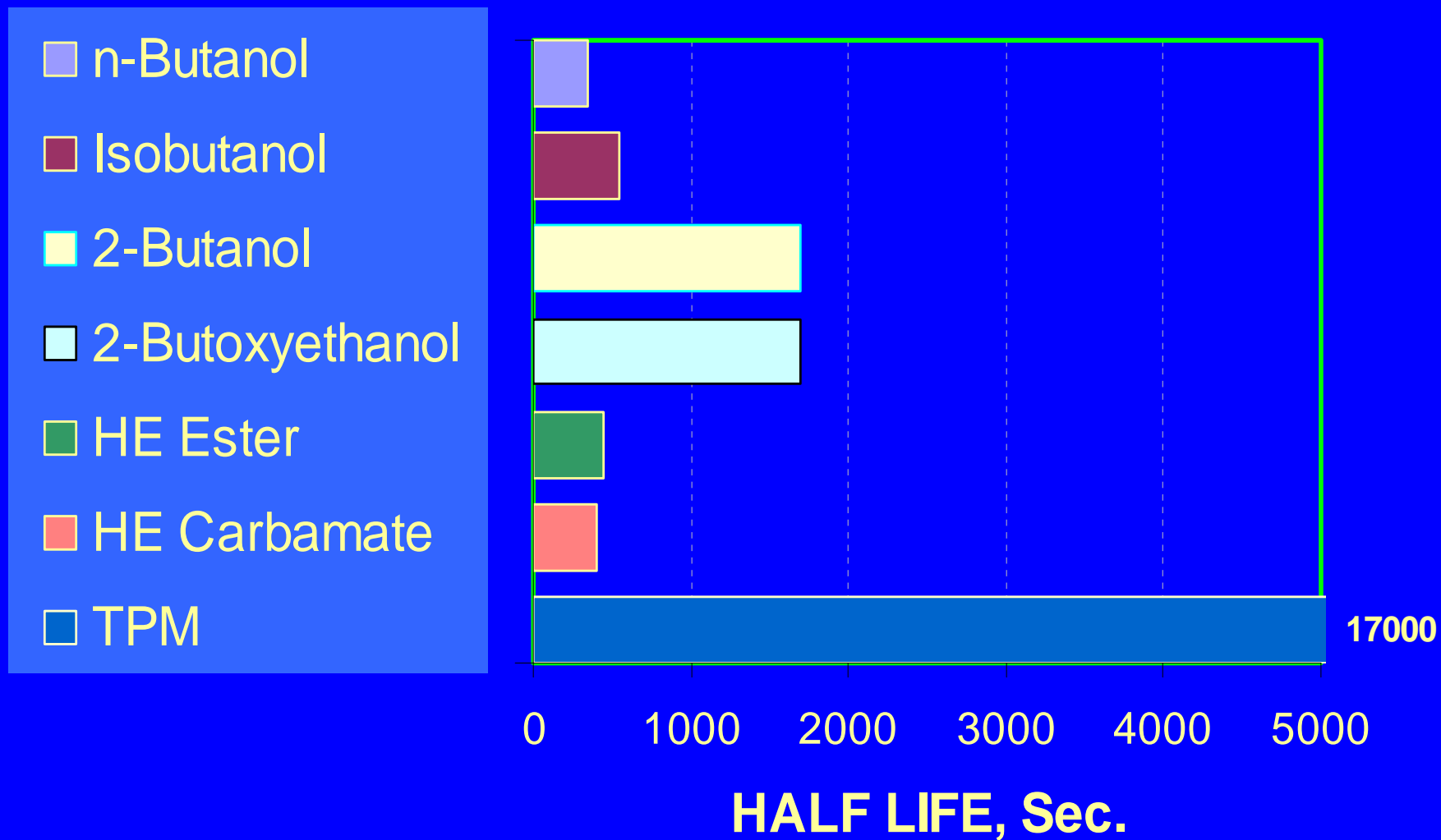
Solvent	Xylene
Isocyanate	HDI trimer
Isocyanate concentration, mol/l	1.12
NCO/OH	1/1
Temperature, °C	20

HDI-TRIMER DBTDL 0.014 % Sn



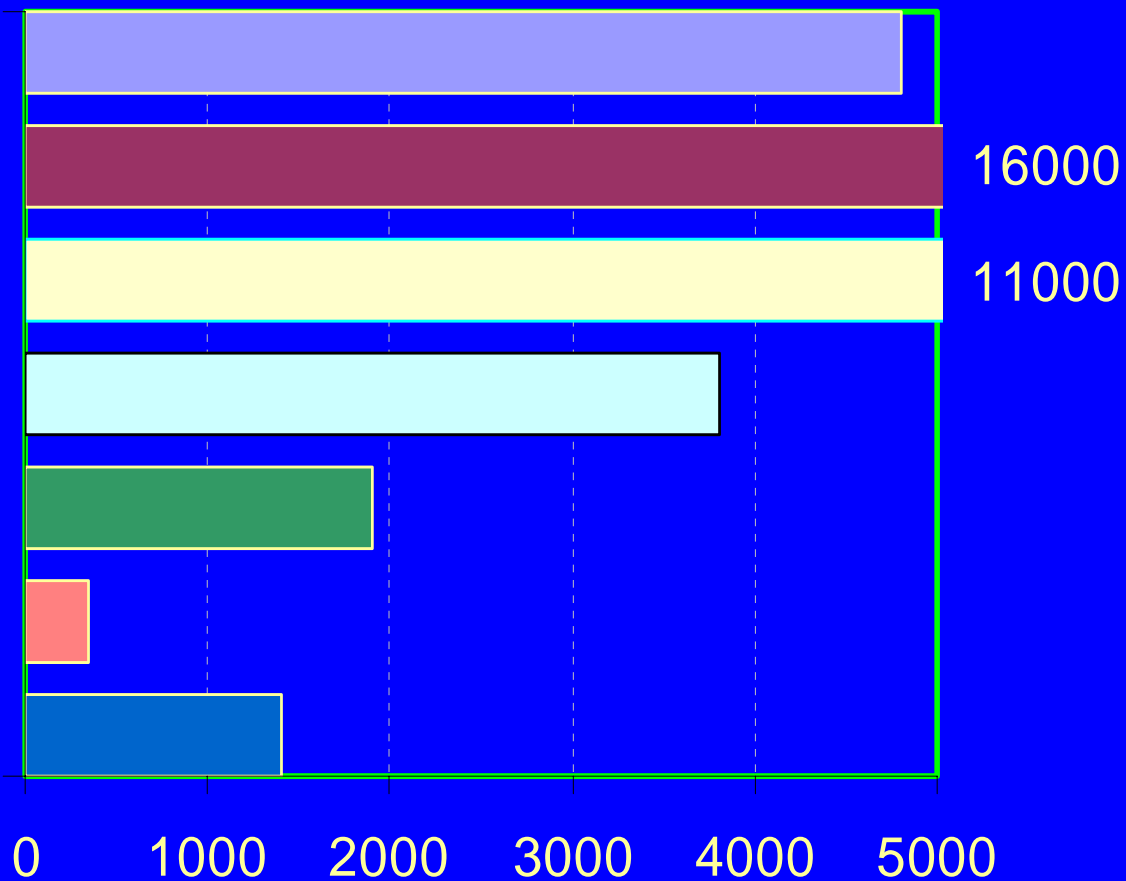
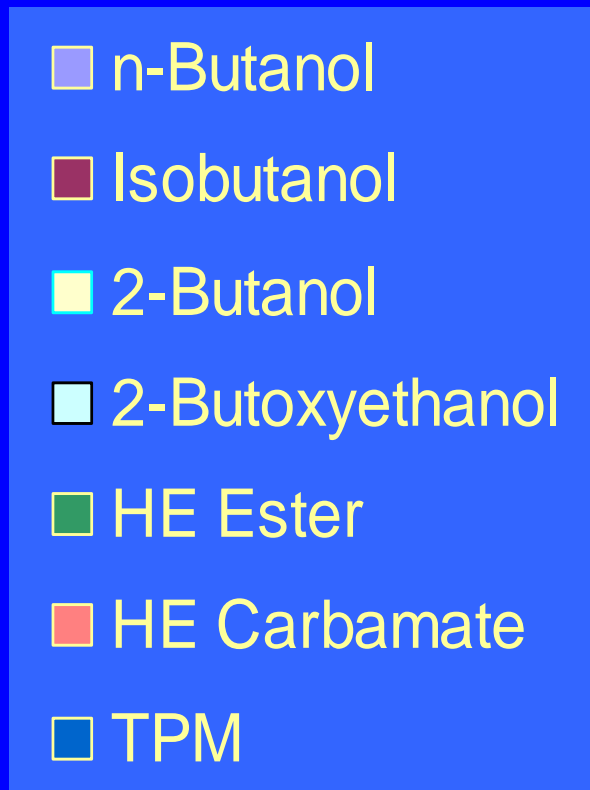
HDI-TRIMER

Zr Chelate 0.014 %Zr



HDI-TRIMER

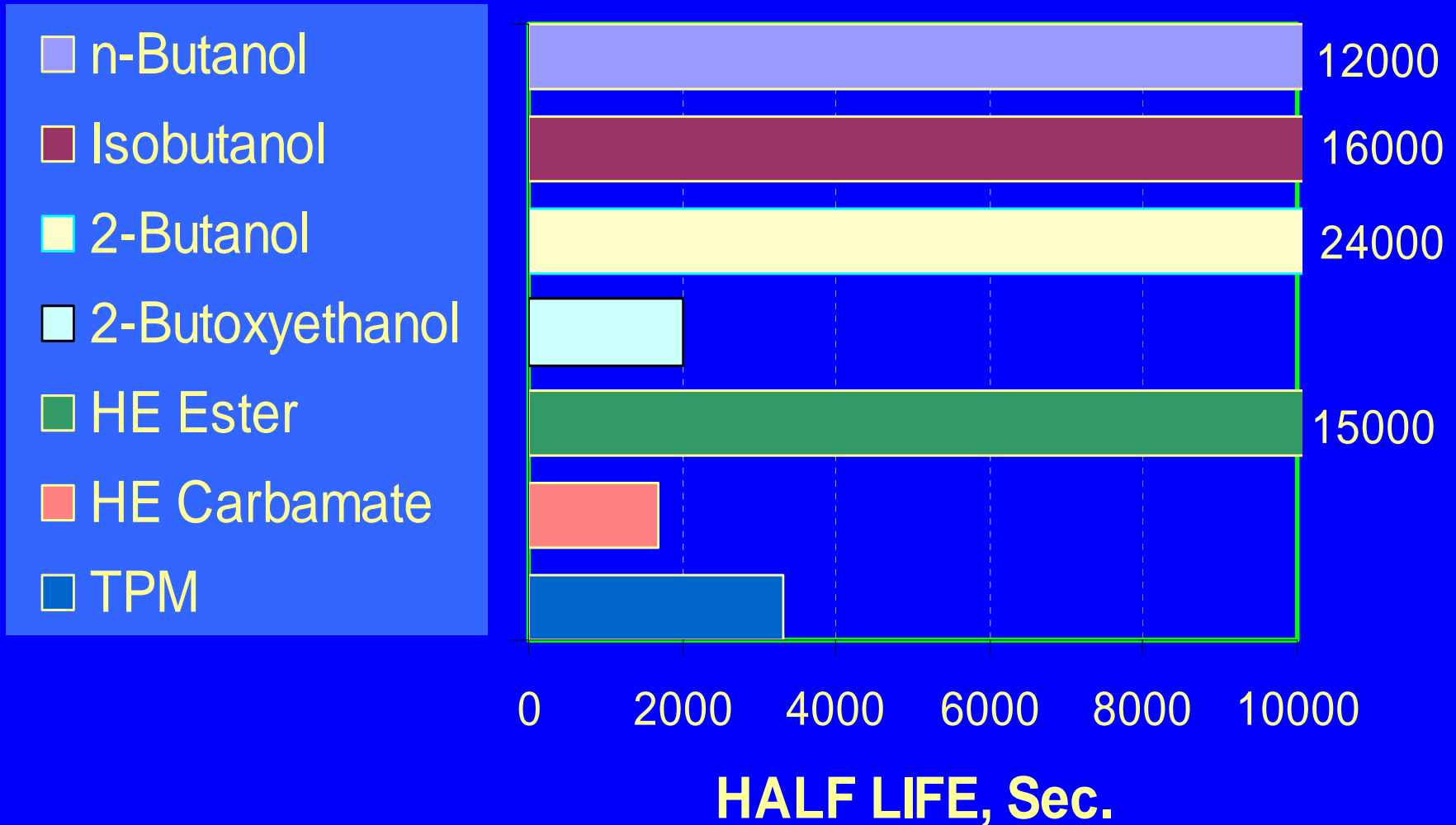
Bi Carboxyl 0.14 % Bi



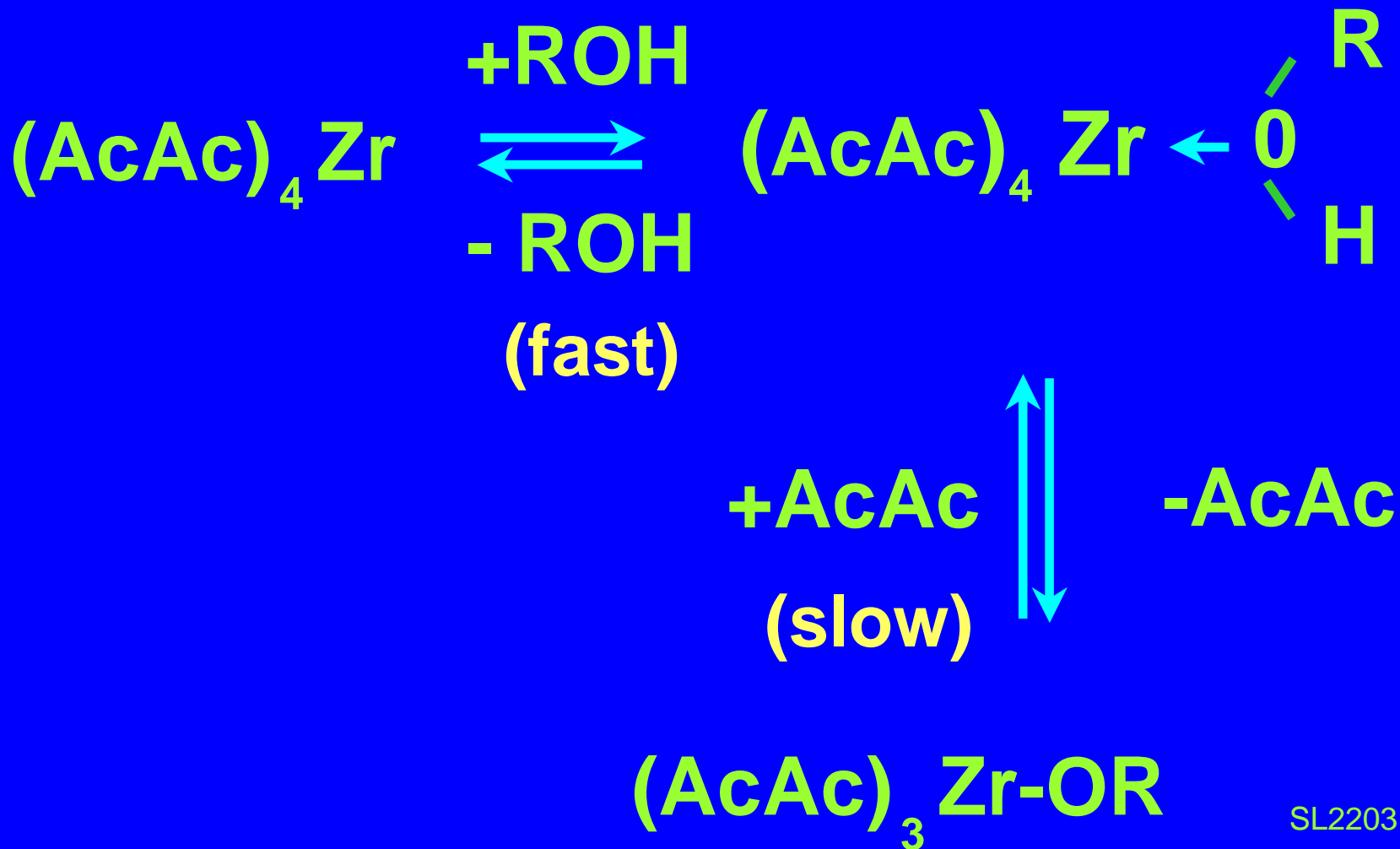
HALF LIFE, Sec.

HDI-TRIMER

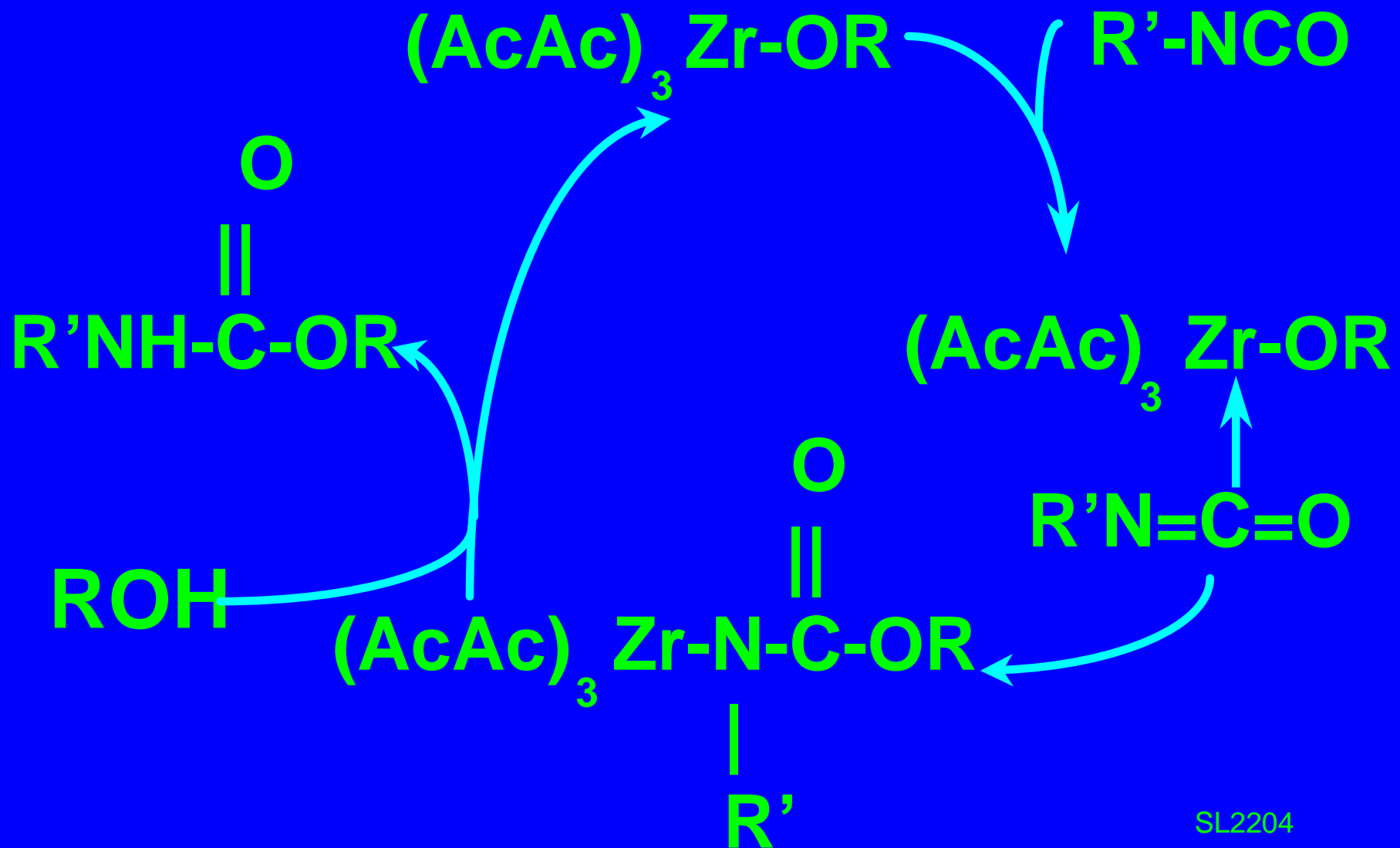
Zn Carboxyl 0.27 % Zn



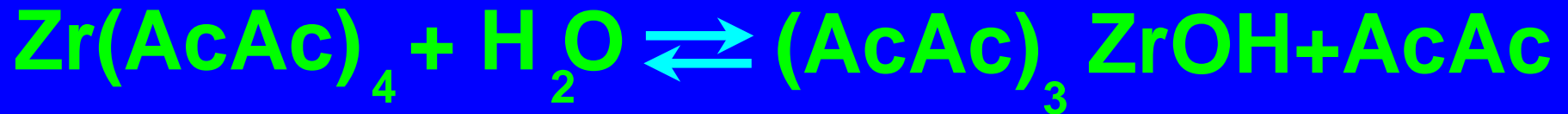
ZIRCONIUM CHELATE CATALYSIS

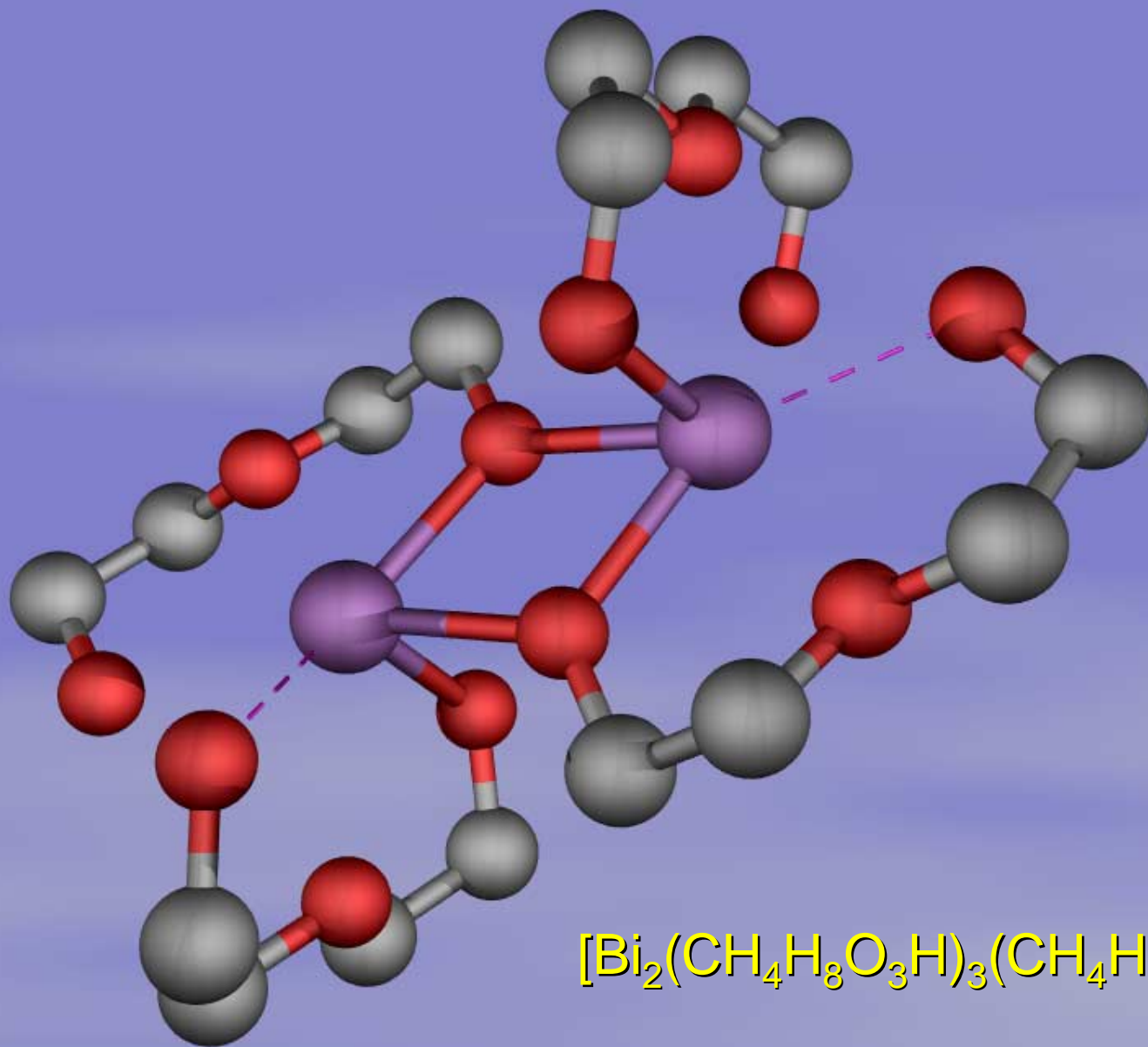


ZIRCONIUM CHELATE CATALYSIS

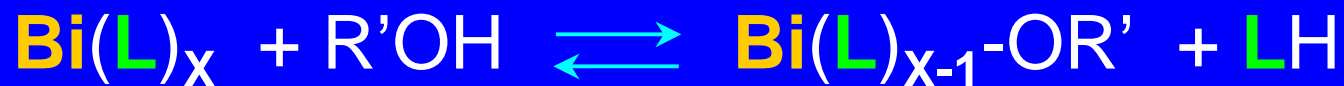


HYDROLYSIS OF Zr CHELATE

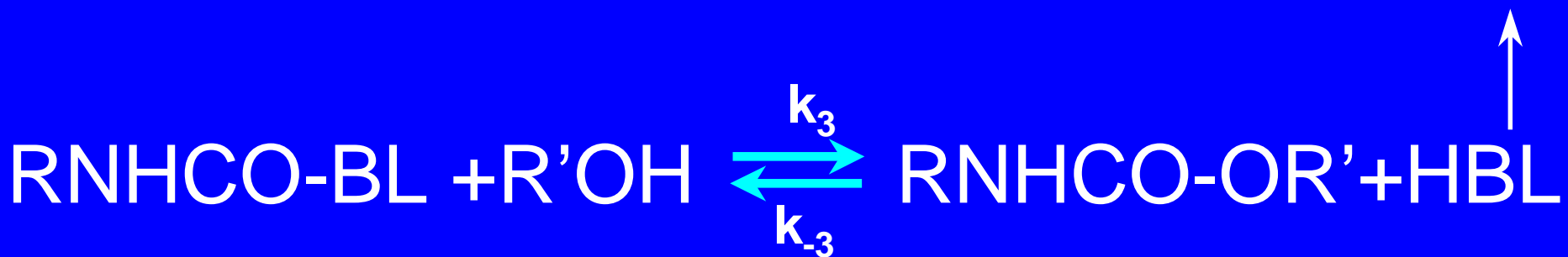
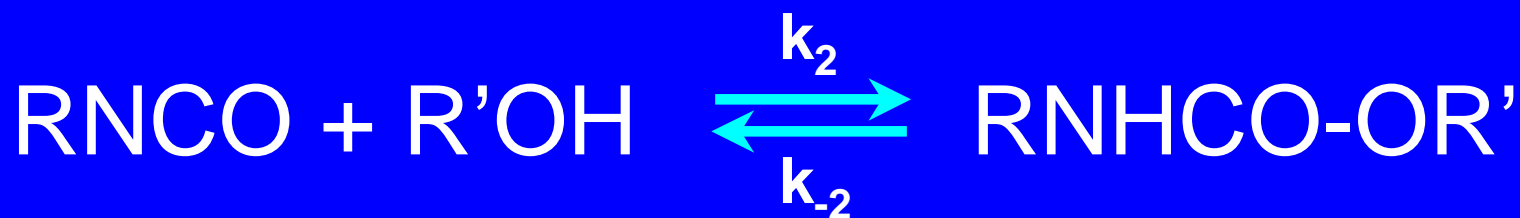
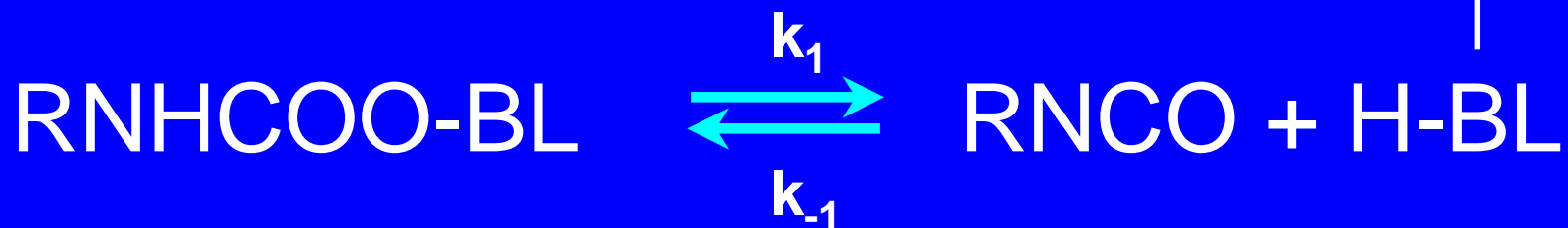




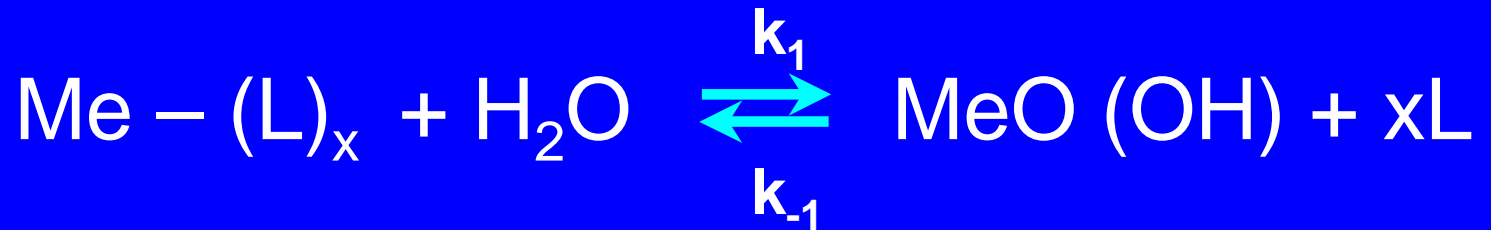
Bismuth Catalysis



REACTION OF BLOCKED ISOCYANATE



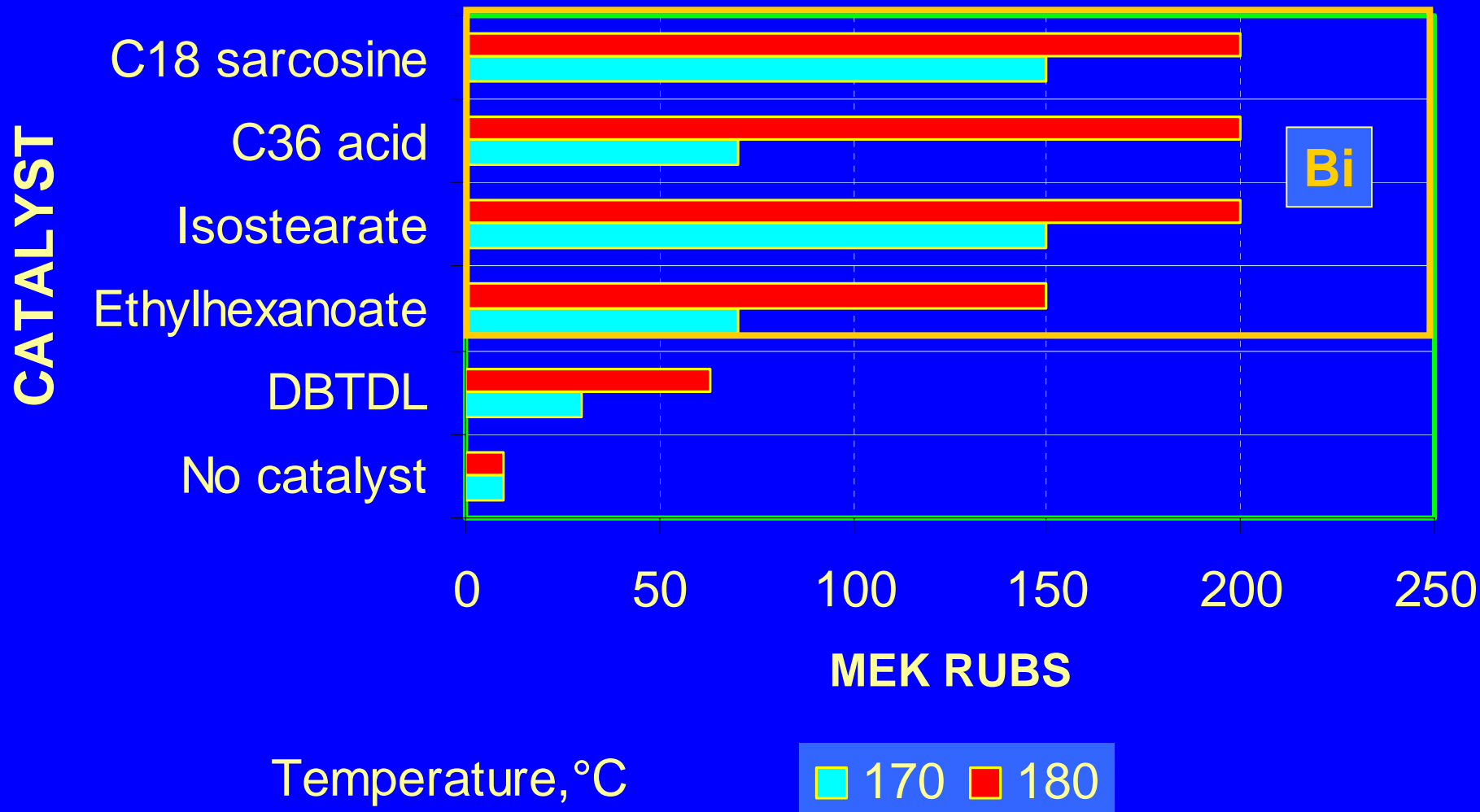
CATALYST DEACTIVATION



CATALYST REACTIVATION

POLYMERIC MDI BLOCKED

Catalyst 0.25 % Me



BLOCKING AGENTS - CATALYSTS

Malonate

Uretdione

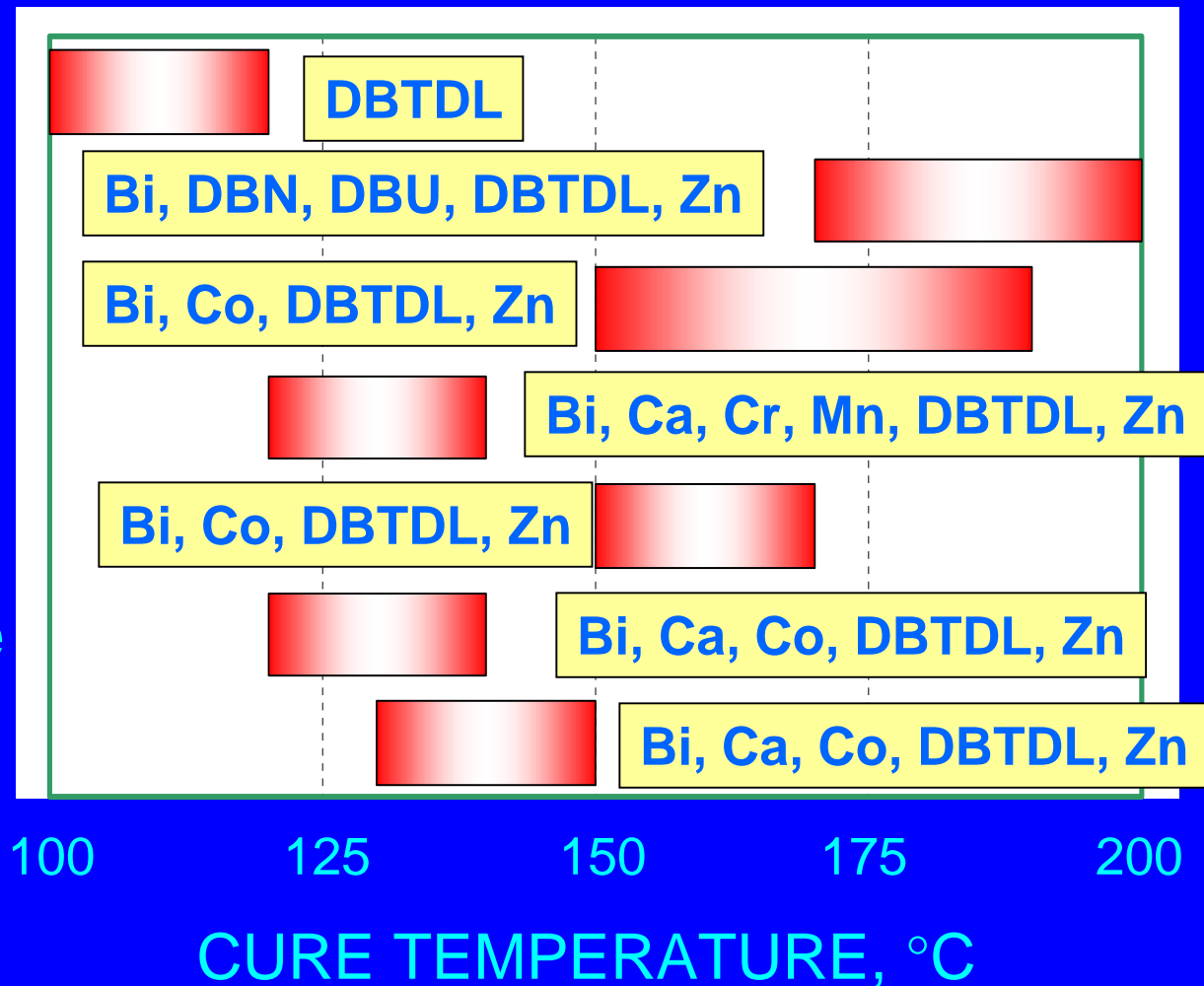
Alcohol

Phenol

Caprolactam

Dimethylpyrazole

Ketoxime



AUTOMOTIVE CLEARCOATS

Crosslinker

Melamine-formaldehyde

Isocyanate

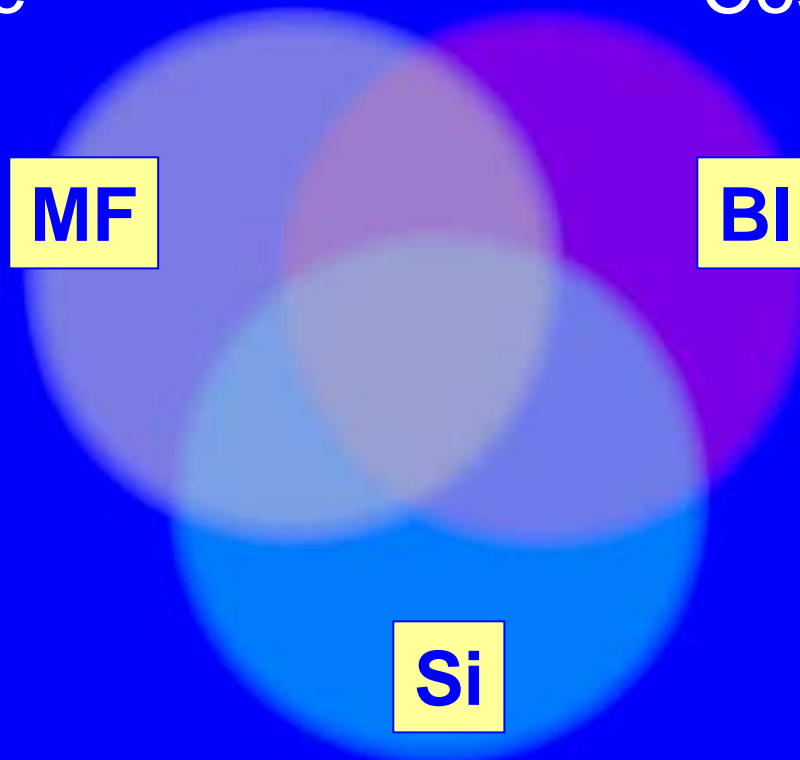
Siloxane

Weakness

Acid etch

Scratch

Cost



HYBRID CROSSLINKING

Melamine

R-PO₄A

Bi. Isocyanate

RSO₃H/A

Zn-CH

DBTDL

R-PO₄A

RSO₃R'

Al-Ch

Bi-Carb

DBTDL

Siloxane

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