



PU TECHNICAL DAY
October 31st, 2018



Synthene





Who is Synthene ?

- ❖ A PU formulator and producer, located in France
- ❖ Founded in 1958





From the origins to the present day

Foundation
of the
company

American
manufacture
license of
PU

Transparent
resin for label
doming,
sport floors

Synthesis
becomes
Synthene

Hot-
cast
PU

1958

1960

1970

1980

1990

2000

2010

2018

Activity :
PLASTISOL

Development
of
detergency
activity

Development
of own
formulation

Junction
blocks
etancheity

Development
of resins for
rapid
prototyping



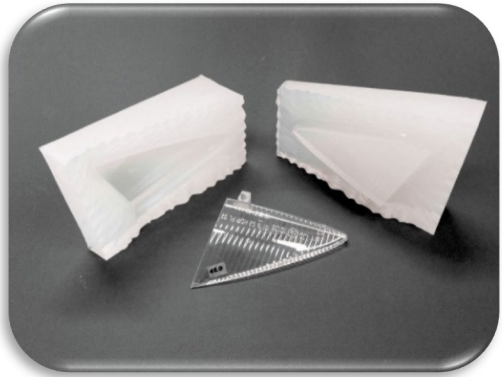
A few figures...

- ❖ 28 people, with among them 5 in the R&D department
- ❖ A presence in more than 30 countries over the world
- ❖ Adjustable yearly production capacity : from 1000 to 3000 tons (PU + PVC) per year





a PU specialist



PU resins for
rapid
prototyping

PU
elastomer
for industry

FORMULATION

PU gel resins
for medical
comfort

PU resins for
cable
insulation





Main activity : formulation

FORMULATION

**of ready-made or taylor-made
technical solutions
for our partners***

* All formulas developed by our laboratory remain the property of Synthene



Raw material selection



- ❖ ISO 9001 : certification
- ❖ Selection : TDS / MSDS / sample
- ❖ Trial order / evaluation questionnaire
- ❖ Yearly report
- ❖ Assessment on specific points



A high focus on Quality & HMS

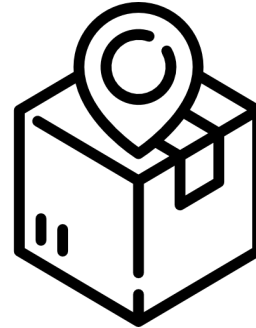
- ❖ ISO 9001 : 2015 certification
- ❖ Control of the incoming materials
- ❖ Control of the finished products
- ❖ Dedicated room for control samples





A high focus on Quality & HMS

- ❖ Certificate of analysis / certificate of conformity
- ❖ Tracking system at each step
- ❖ Claim rate : 0.2% in 2017
- ❖ MSDS Software : ExEss
- ❖ External safety consultant



Questions & Answers

Polyurethane chemistry





What type of chemistry ?

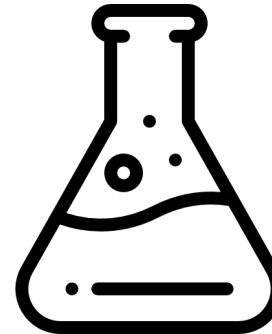
Polyols

❖ Polyether polyol :

- Resistance to hydrolysis
- Limited resistance to chemical aggressions
- Good mechanical behaviour on a large scale of temperatures

❖ Polyester polyol :

- Solid at room temperature
- Good chemical characteristics
- Not recommended for water contact





What type of chemistry ?

Amines

❖ Aliphatic amine :

- Recommended when curing speed is required

❖ Aromatic amine :

- Mechanical performance
- Thermal performance

MOCA

4,4'-Methylenebis(2-chloroaniline)



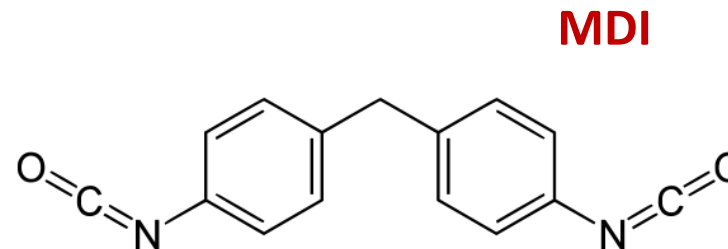
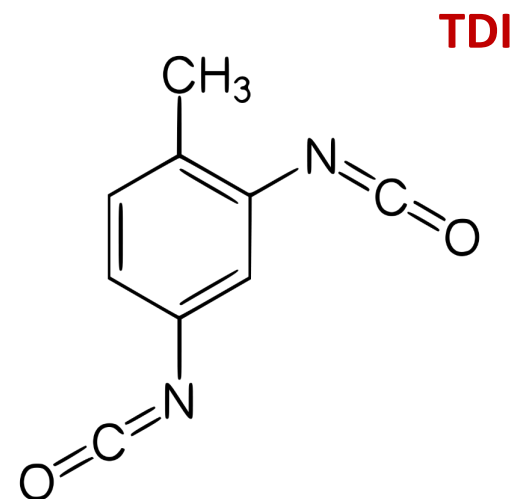
What type of chemistry ?

Isocyanates

- ❖ Toluene di-isocyanate
- ❖ Diphenylmethylene di-isocyanate

- ❖ Characteristics :

- Good quality/price ratio
- MDI : Limited toxicity
- TDI : Good chemical resistance





What type of chemistry ?

Combinations

❖ Prepolymers :

- Decreasing of the monomer toxicity
- Combination of the monomer (TDI or MDI) with a polyether or a polyester polyol



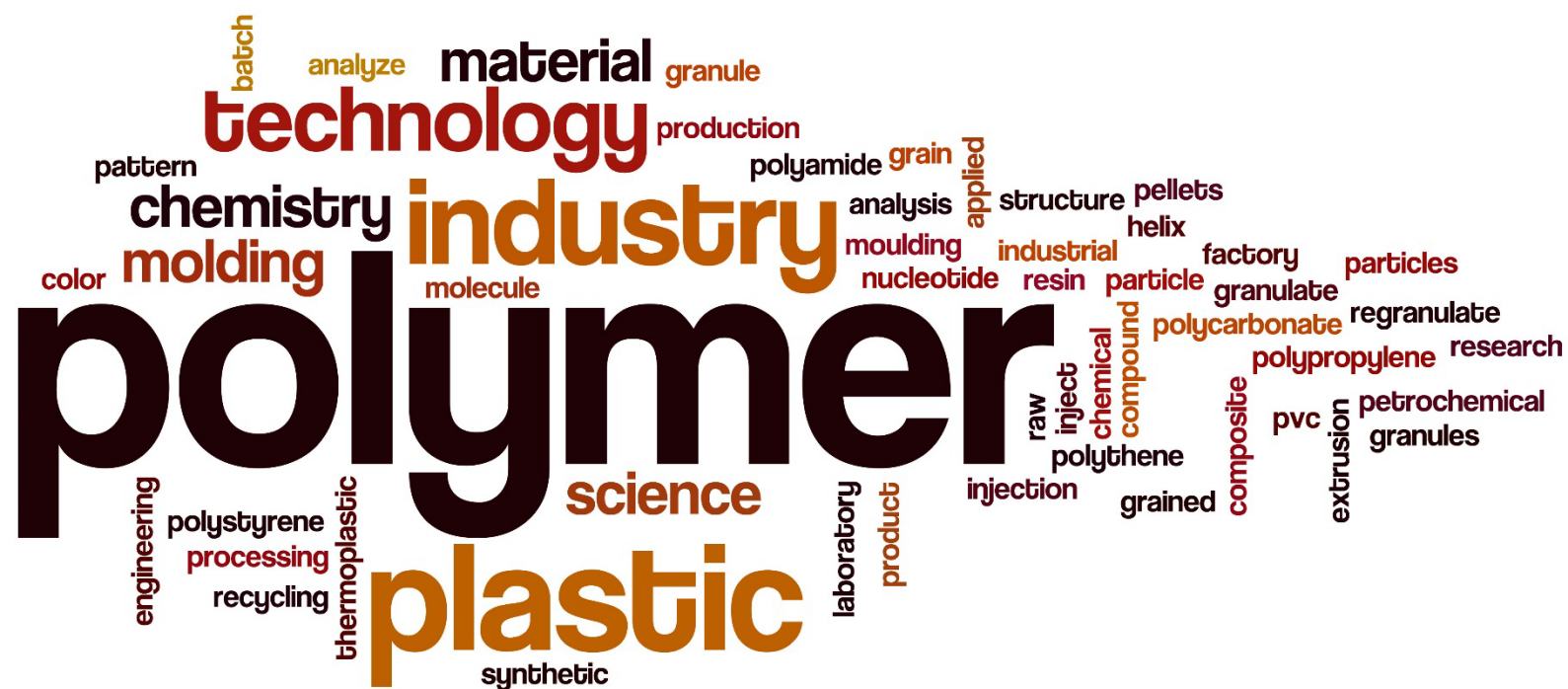
❖ Aliphatic derivatives :

- Low coloration
- High resistance to UV
- Not adapted for outdoor parts



Questions & Answers

Polyurethane market





What markets are impacted ?

- ❖ Oil & gas
- ❖ Machine construction
- ❖ Mining industry
- ❖ Offshore energy
- ❖ Fishing industry
- ❖ Building/concrete
- ❖ Packaging...





MOCA & regulation

	Substance	Intrinsic property (s) referred to in Article 57	Latest application date	Sunset Date
27	2,2'-dichloro- 4,4'- methylenedianiline (MOCA) No CE: 202-918-9 No CAS: 101-14-4	Carcinogenic (Category 1B)	22 May 2016*	22 November 2017**

(*) 1 September 2019 for the use of substances in the production of **spare parts** for the repair of articles the production of which ceased or will cease before the sunset date indicated in the entry for that substance, where that substance was used in the production of those articles and the latter cannot function as intended without that spare part, and for the use of the substance (on its own or in a mixture) for the repair of such articles when this substance on its own or in a mixture was used in the production of those articles and the latter cannot be repaired otherwise than by using that substance.

(**) **1 March 2021** for the use of the substance in the production of spare parts for the repair of articles the production of which ceased or will cease before the sunset date indicated in the entry for that substance, where that substance was used in the production of those articles and the latter cannot function as intended without those spare parts, and for the use of the substance (on its own or in a mixture) for the repair of such articles, where that substance was used in the production of those articles and the latter cannot be repaired otherwise than by using that substance.



Expectations for the future

- ❖ Recent history of dangerous goods
 - MDA
 - Di Butyle Phtalate
 - Mercury
- ❖ A more and more responsible industrial market
 - Adaptation to stronger and stronger EHS regulations



Questions & Answers

COFFEE
BREAK



Alternative solutions





Alternatives to MOCA

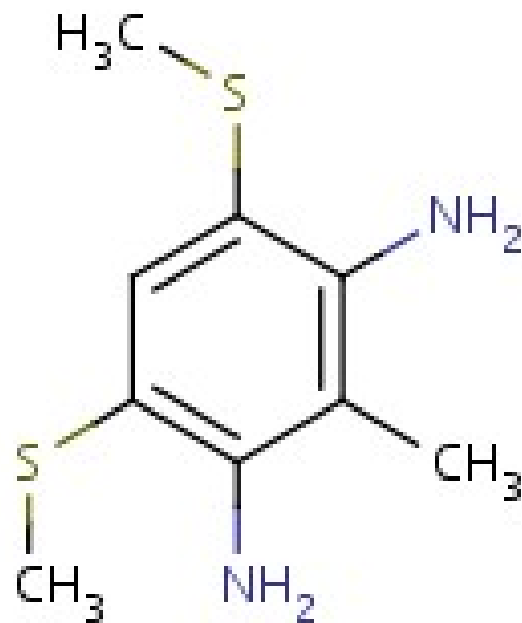
	MOCA	MCDEA	CDETDA	DMTDA
Aspect (RT)	Solid	Solid	Solid	Liquid
Processing temperature	100°C	100°C	< 100°C	>20 °C < 100°C
Reactivity	Approx. 8 min.	4 – 5 min.	3 min.	7 min.
Toxicity	Very high	Limited	Unknown (experimental)	Limited



Synthene's choice






❖ DMTDA

- Specific know-how
- Low reactivity
- Liquid at room temperature
- Ease of process
- Limited toxicity





MOCA VS Synthene's solutions : labelling

MOCA	DMTDA
  	 
Danger	Warning
H302 - Harmful if swallowed.	H302 - Harmful if swallowed.
H350 - May cause cancer.	H317 - May cause an allergic skin reaction.
H410 - Very toxic to aquatic life with long lasting effects.	H410 - Very toxic to aquatic life with long lasting effects.



Isocyanates labelling

- ❖ The toxicity of the isocyanate is directly linked to the quantity of residual monomer in the product
- ❖ Prepolymer : one monomer function has reacted with a reactive component to create a heavier quantity, that is less volatile
- ❖ Synthene has the ability to formulate different isocyanates with various levels of toxicity



Isocyanates labelling

	Polyol	Iso
Formula #1	GHS07	GHS07
	GHS09	GHS08

MDI
+
Low rate of TDI

H302	H302	Harmful if swallowed.
H317	H332	Harmful if inhaled.
H400	H315	Causes skin irritation.
H410	H319	Causes serious eye irritation.
		May cause allergy or asthma symptoms or breathing difficulties if inhaled.
	H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled.
	H317	May cause an allergic skin reaction.
	H351	Suspected of causing cancer.
	H335	May cause respiratory irritation.

	Polyol	Iso
Formula #2	GHS07	GHS07
	GHS09	GHS08

Low rate of TDI

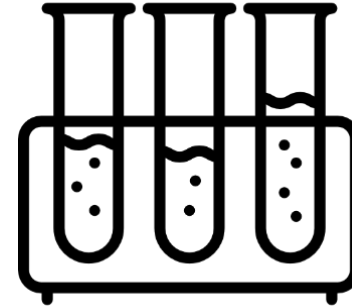
H302	H302	Harmful if swallowed.
H317	H332	Harmful if inhaled.
H400	H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled.
H410		



Synthene's assets

❖ Formulation

- Pre-polymer technology
- Independant laboratory



❖ Adaptation

- Lower volumes projects
- Our goal : adapt to the specific requirement of the customer





MOCA VS Synthene's solutions

	Synthene	MOCA-based competitor material
Viscosity at room temp	6800 mPa.s	Solid
Processing temperature	Room temp or 50°C	120°C
Mold temperature	70°C	100°C
Potlife	10 min	7 min
Hardness	90 Shore A	90 Shore A
Tensile Strength at Break	27 MPa	58 MPa
Tear Strength	90 kN.m-1	100 kN.m-1
Elongation at Break	800%	550%



Safety instructions for the process

❖ Personal protective equipment

- Gloves / wash hands
- Safety goggles
- Protective clothing
- In case of insufficient ventilation :
Suitable respiratory equipment



Questions & Answers

Synthene elastomer ranges

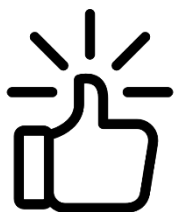




Synthene's elastomers

90 Shore A	1	2	3
Casting	Cold-casting post-curing 70°C	Cold casting post-curing at RT or 70°C	Hot-cast PU post-curing at 100°C
Viscosity	Low viscosity	Medium viscosity	High viscosity
Mixing ratio	Easy	Medium (3 component)	Precise
Potlife	Short	Long	Short
Demoulding time	60 min	12 hours	30 min to 24 hours
Part size	Small (15mm)	Medium (30mm)	Big (100mm)
Tear resistance	30 kN.m ⁻¹	60 kN.m ⁻¹	80 kN.m ⁻¹
Resilience	Low	Medium	High

User-friendliness



Performance





HPE range

	40A	50A	60A	70A	85A	90A	55D
HPE 40A Polyol	100	75	50	25			
HPE 85A Polyol		8	16	24	32	40	50
HPE 40-85 Iso	100	100	100	100	100	50	
HPE 55D Iso						50	100

Viscosity (mPa.s)	2000	2400	2700	3000	3200	2500	1600
Potlife on 300g at 25°C (min)	60	55	50	45	40	15	8
Demoulding time (h)	24	24	24	24	24	12	10
Max. casting thickness (mm)	100	80	80	60	50	30	20
Elongation at break at 23°C (%)	270	400	500	800	900	850	750
Tensile strength at break (MPa)	2.7	3.6	6	7.2	13	14	15
Tear strength (kNm-1)	11.5	18	27	40	54	64	74



HPE 55D - New version

	85A	95A	50-55D
HPE 85A Polyol	32	50	75
HPE 40-85 Iso	100	50	
HPE 55D New Iso		50	100

Viscosity (mPa.s)	3200	1800	1300
Potlife on 300g at 25°C (min)	40	25	18
Demoulding time (h)	24 (3h at 70°C)	12 (2h at 70°C)	10 (2h at 70°C)
Max. casting thickness (mm)	50	30	20
Elongation at break at 23°C (%)	900	460	325
Tensile strength at break (MPa)	13	14	16
Tear strength (kNm-1)	54	58	70



Examples of applications

- ❖ Concrete moulds
- ❖ Joints
- ❖ Bellows
- ❖ Protection part
- ❖ Sanding stencil
- ❖ Wheels



Questions & Answers

Hot-cast PU in Synthene





Versatile product

Versatile 93 Shore A product for many applications like :

- Bend restrictors
- Diabolo-shaped parts
- Wheels

Main properties : Tear & Abrasion resistance

Viscosity	4000 mPa.s
Maximum casting thickness	100 mm
Tensile strength at break	26 MPa
Elongation at break	600 %
Tear resistance	77 kN.m ⁻¹
Abrasion resistance	22 mg/100U





Versatile product #2

90 Shore A product :

- Room temperature casting option
- Post-curing
- Limited toxicity

Viscosity	6700 mPa.s
Maximum casting thickness	40 mm
Tensile strength at break	34 Mpa
Elongation at break	900 %
Tear resistance	90 kN.m ⁻¹





Cable ballast

High density material :

- Density 2,35
- Room temperature casting option (+post-curing)
- High hydrolisis resistance

Hardness	85 Shore A
Viscosity	50 000 mPa.s
Tensile strength at break	3,5 MPa
Elongation at break	663 %
Tear resistance	19 kN.m ⁻¹
Abrasion resistance	107 mg/100U



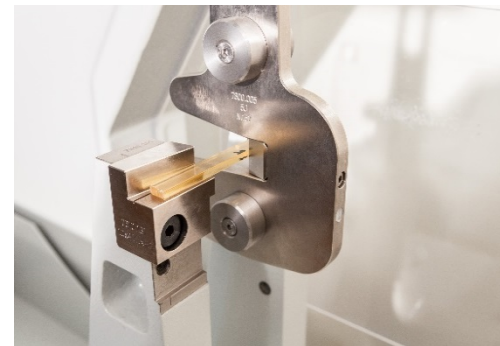


Impact resistance

Hardness	80 Shore D
Viscosity	4 000 mPa.s
Maximum casting thickness	80 mm
Flexural modulus	1000 MPa
Maximum flexural strength	35 MPa
Tensile modulus	1000 MPa
Tensile strength at break	35 MPa
Elongation at yield	10 %
Charpy impact resistance (5 joules hammer)	>30 Kj/M2

Shock-proof material :

- Explosive forming applications
- Safety scaffold hatch systems
- Car or machine body
- Jackhammer casing





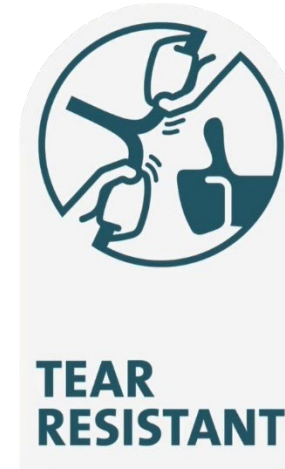
Application examples

- PU roller coating
- Diabolo rollers
- Sieve mesh
- Concrete mould
- Buffers, bushings and springs
- Compression springs
- Screening star
- Support ring
- Snow blades
- Bend stiffeners
- Bend restrictor
- Cable protection
- Piggyback clamps
- Cable ballast



Questions & Answers

Technical support





Technical equipment

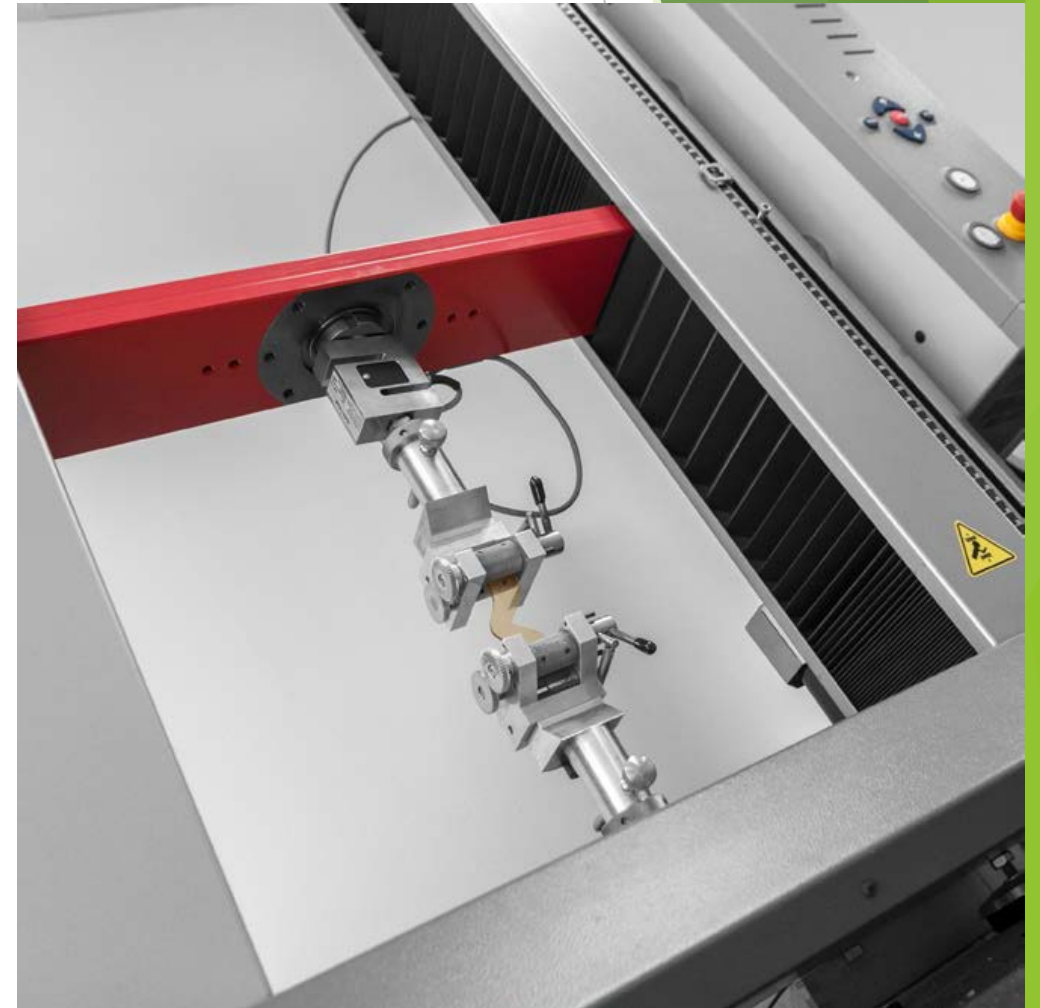
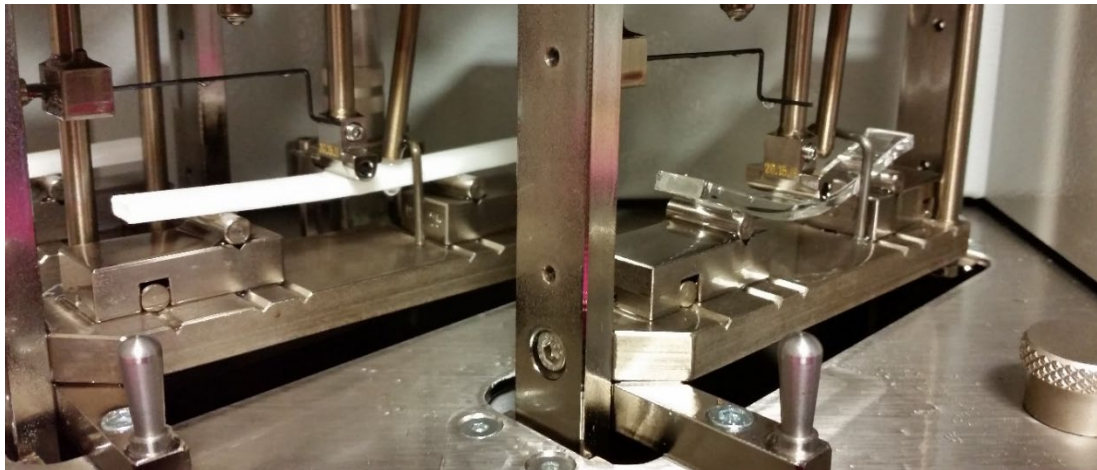
- ❖ Rheometer – viscometer ANTON PAAR
- ❖ Spectrophotometer MINOLTA ISO 2211
- ❖ Spectrometer RAMAN
- ❖ 5 joules CHARPY impact resistance INSTRON ISO 179-1
- ❖ TABER Abrasion resistance machine ISO 5470





Technical equipment

- ❖ Accelerated ageing machine
(QUV-spray weathering test) Q-PANEL
- ❖ Flexural strength ISO178
- ❖ Tensile strength / Tear resistance ISO 34/37
ZWICK ISO 527
- ❖ HdT measurement machine ISO 75
INSTRON





Lindberg & Lund technical equipment



❖ Lindberg & Lund
technical room



Customer projects

- ❖ Project management
 - Defining the specification list
 - Formulation & follow-up of the project

- ❖ Customer / distributor / supplier partnership
 - Synthene + Linberg & Lund
 - Available common apprentice

Questions & Answers

RIM Machine





Technical equipment

❖ DELTA RIM machine





Main components

Main component	Technical performances
Mixing head	<ul style="list-style-type: none">• Simple conception• Easy maintenance
Product tanks (A and B components)	<ul style="list-style-type: none">• Maximum capacity for each product : 12 Liter per tanks• Water jacket for temperature regulation
Pumps (A and B components)	<ul style="list-style-type: none">• Independant gear pump for each part• High precision for the dosage
Heat controller	<ul style="list-style-type: none">• Maximum temperature output : 90 °C• Guarantees a homogeneous temperature
Flow sensor	<ul style="list-style-type: none">• Flow sensors are available to instantly control the flow rate



Steps to check before the casting

- ❖ Vacuum level : 5 to 6 bars
- ❖ Check the alarm systems
- ❖ Start the heat controller
- ❖ Preheat the mold (70°C)
- ❖ Set the recirculation mode before using
- ❖ Check the temperature parameters





Steps to check during the casting with the control panel

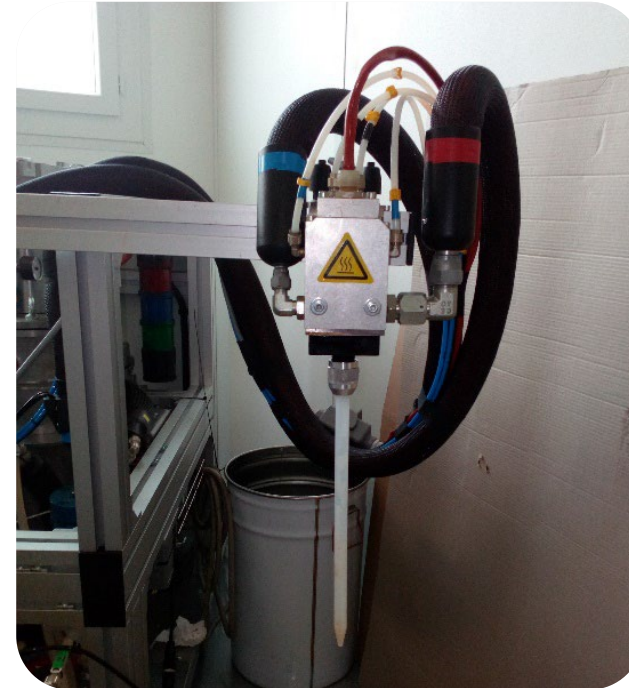
- Main control
 - ❖ Temperature control
 - ❖ Flow rate control
 - ❖ Pressure control
- How to control?
 - ❖ « In live » control of the casting parameters
 - ❖ Programming out of range alarms





Mixing and dosage

- ❖ Mixing ratio can be changed and controlled easily
- ❖ Calibrating the good mixing ratio is the important part of the process
- ❖ Static mixer offers a guarantee of an homogeneous flow during the injection step





To sum up

- ❖ The machine is user-friendly
- ❖ High level of precision to test experimental Products
- ❖ Could be used for little series production



Thank you for
your attention

Questions
& Answers



Credits

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