



Wanhua waterborne synthetic leather solution

*Wanhua Chemical
Emerging Technology Business Group
Feb., 2021*



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01

**Wanhua company –
Emerging technology BU**

Wanhua development history



1978-1983

Yantai Wanhua
synthetic Leather
Factory



2003-2005

Wanhua Ningbo
Industrial Park



2011-2015

Wanhua Yantai
Industrial Park



2017

Wanhua Zhuhai
Industrial Park



1998-2001

Yantai Wanhua Polyurethanes Co.,
Ltd.
Shareholder restructure (code
600309)



2011

Acquire BorsodChem
via a 1.26bn Euro M&A deal



2013

Wanhua Chemical Group
Co., Ltd

Overseas position

Italy: BorsodChem Italia s.r.l.

Czech: BorsodChem MCHZ, s.r.o.

The USA: Yantai Wanhua America Co., Ltd.

The USA: Wanhua Chemical US Holding Inc.

Brazil: Wanhua BorsodChem Latin America
Assessoria comercial Ltda.

Turkey: BorsodChem (Turkey) office

Hungary: BorsodChem Zrt.

Russia: Wanhua BorsodChem (Russia) Co., Ltd.

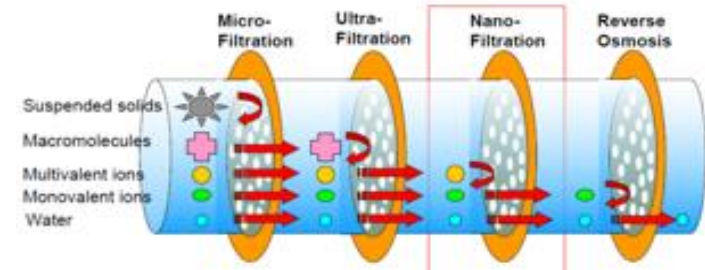
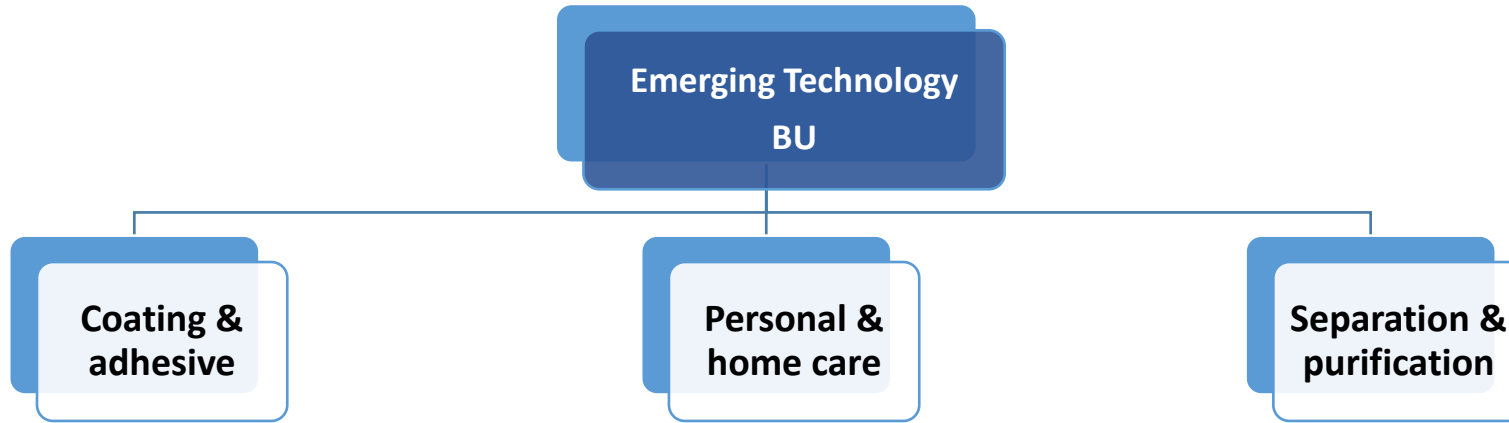
Japan: Wanhua Chemical Japan Co., Ltd.

South Korea: Wanhua Chemical
(South Korea) office

India: Wanhua International (India)
Private Limited

The UAE: Wanhua Chemical (The UAE) office







PU

- Global distributed, worldwide scale and with integrated supply chain
- Leading position in the global isocyanate industry. Also coordinated by polyol products

- ✓ MDI
- ✓ TDI
- ✓ Flexible foam polyol
- ✓ Rigid foam polyol
- ✓ Polyester Polyol
- ✓ MDI Variant



Petrochemicals

- World-class PDH plant, PO/MTBE and ethylene cracking plant
- Focusing on C3/C4 product chain
- Prioritize products that have collaborative effects with PU

- ✓ Propylene
- ✓ PO
- ✓ PP
- ✓ MTBE
- ✓ AA+AE
- ✓ Butanol
- ✓ MMA
- ✓ Ethylene
- ✓ Styrene
- ✓ HDPE
- ✓ LLDPE
- ✓ PVC



Specialty Chemicals

- Customized materials made of feedstock from the monomers in PU and acrylates industrial chain
- Develop special amine and phosgenation products and special derivatives to be used in other industries

- ✓ **Surface materials**
- ✓ TPU
- ✓ PU Catalysts
- ✓ SAP
- ✓ Specialty Amine
- ✓ ADI
- ✓ PC
- ✓ NPG
- ✓ Specialty Acrylate
- ✓ EOD
- ✓ PMMA
- ✓ Other C3/C4 derivatives
- ✓ Fine chemicals in Isobutene downstream

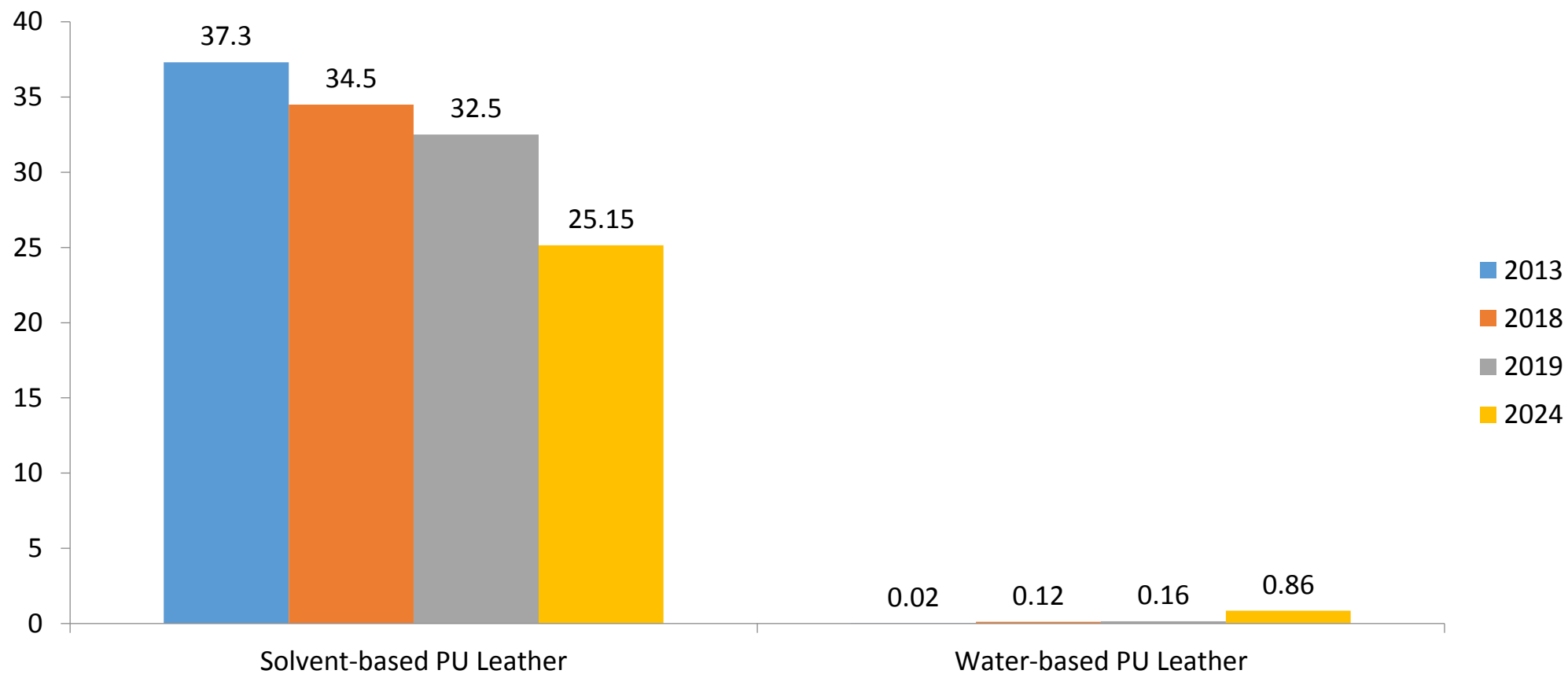




02

**Waterborne synthetic
leather solutions**

Synthetic leather production in Asia Pacific(Unit, 100 million meters)



➤ Production of waterborne PU leather is increasing.

Advantages

- ✓ Excellent breathability and moisture permeability;
- ✓ Production safety;
- ✓ Variety of styles ;
- ✓ Diversification of construction methods

Disadvantages

- Performance: Hand feel and resilience isn't very good
- Process: Production process, equipment transformation need to be further improved;
- Cost: Raw materials, equipment renovation, etc. need more cost;
- Talent: Synthetic leather practitioners lack of understanding

Application



Clothing



Sofa



Luggage



Car



Shoes



Others



Process



Dry process



Wet flocculation process



Impregnation



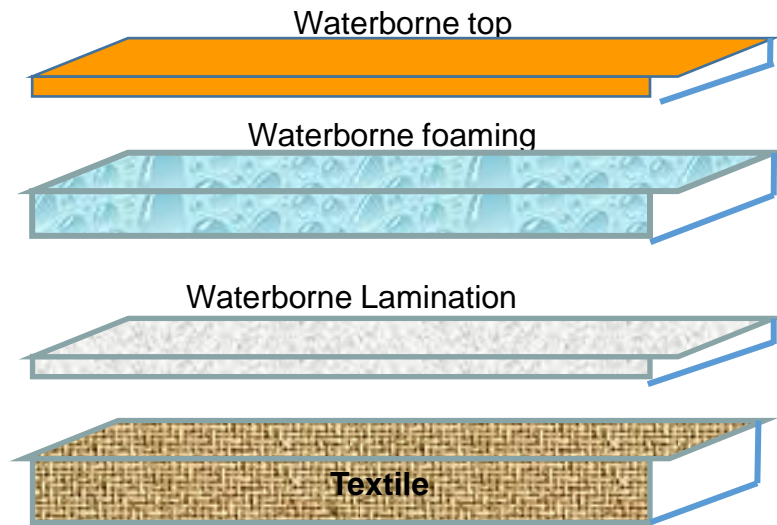
Microfiber



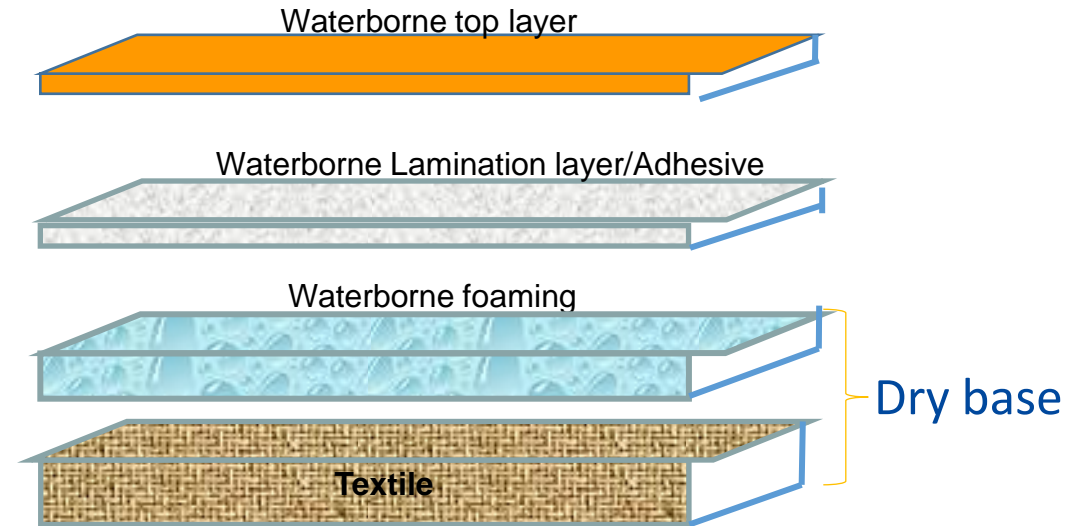
Finishing

Process of water-borne synthetic leather

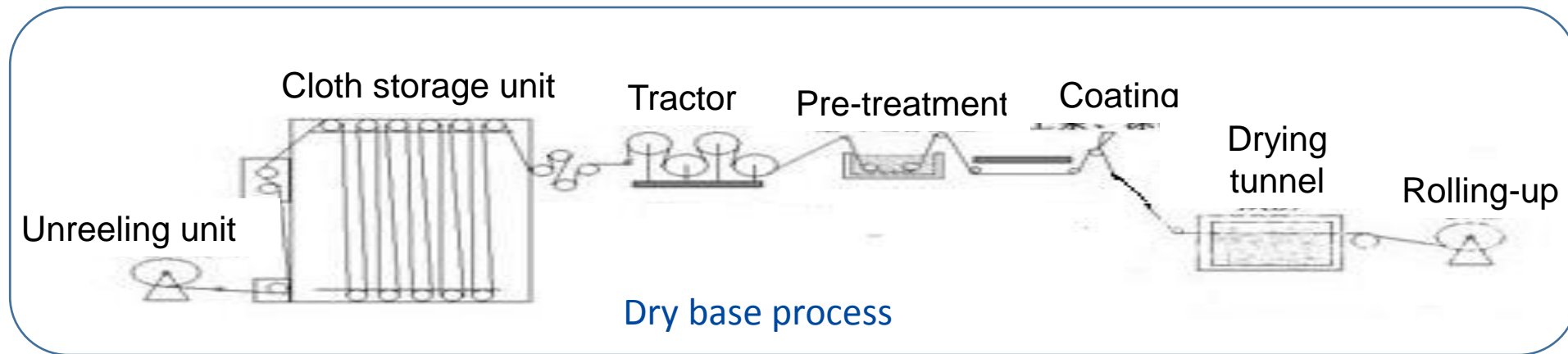
Dry process **Features:** Simple process and high cost performance; Good embossing;



Mode 1-One step



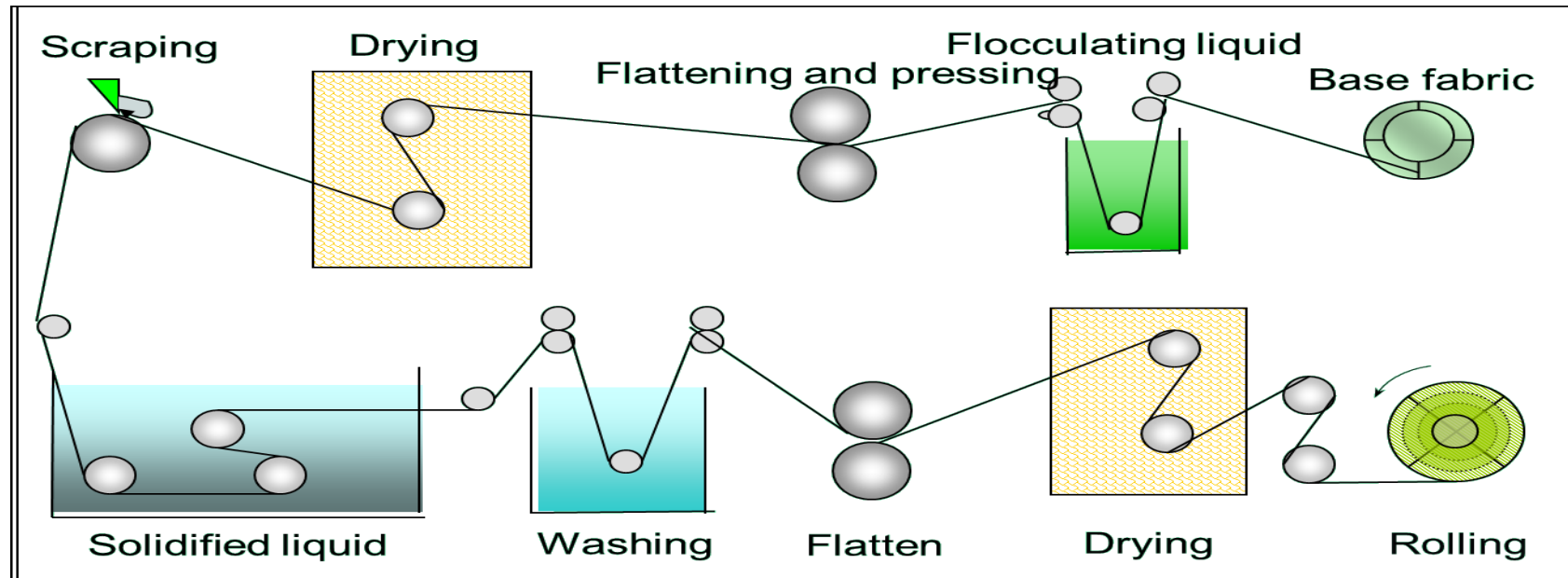
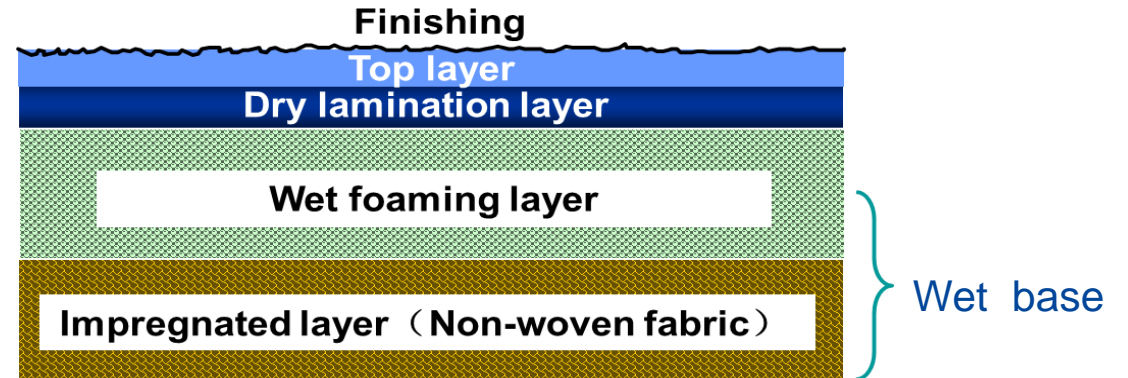
Mode 2-Two steps



Wet process

Features:

- ✓ Soft-feel, drape effect ;
- ✓ Good resilience ;
- ✓ Good stability ;
- ✓ Complex process and high cost;

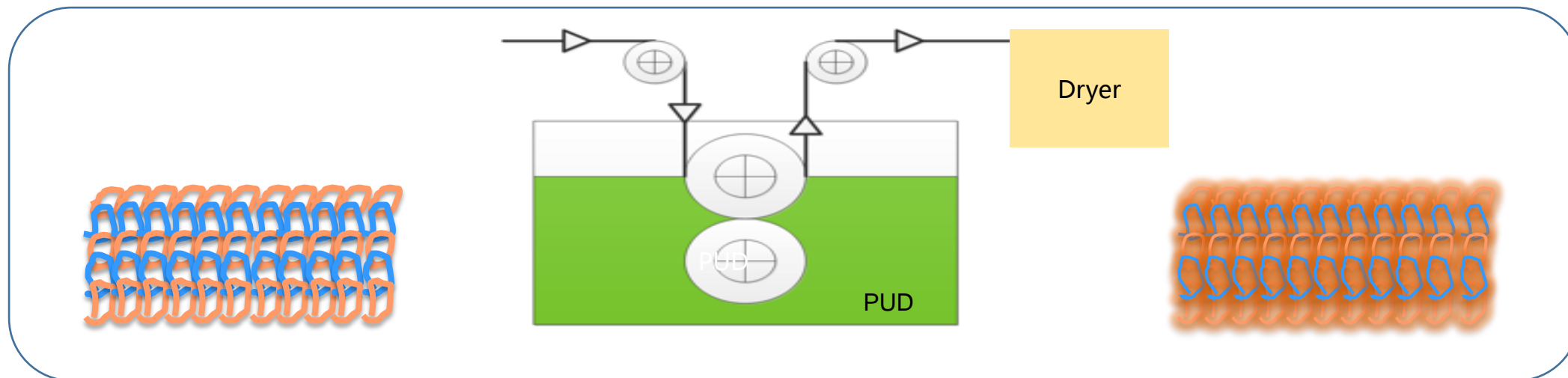


Wet base process

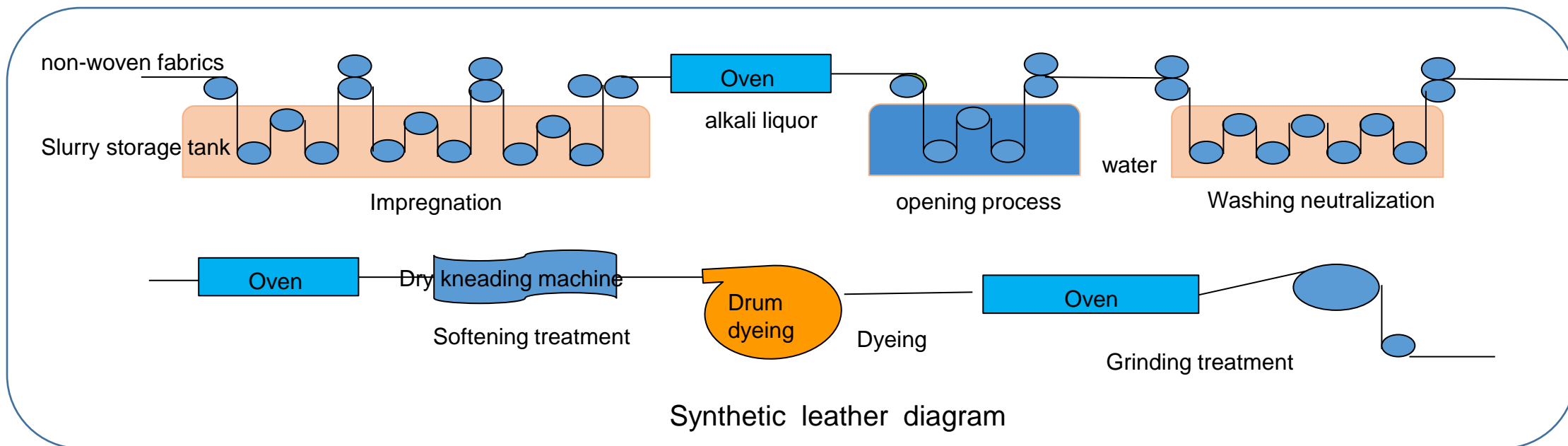
Impregnation process (Suede leather)

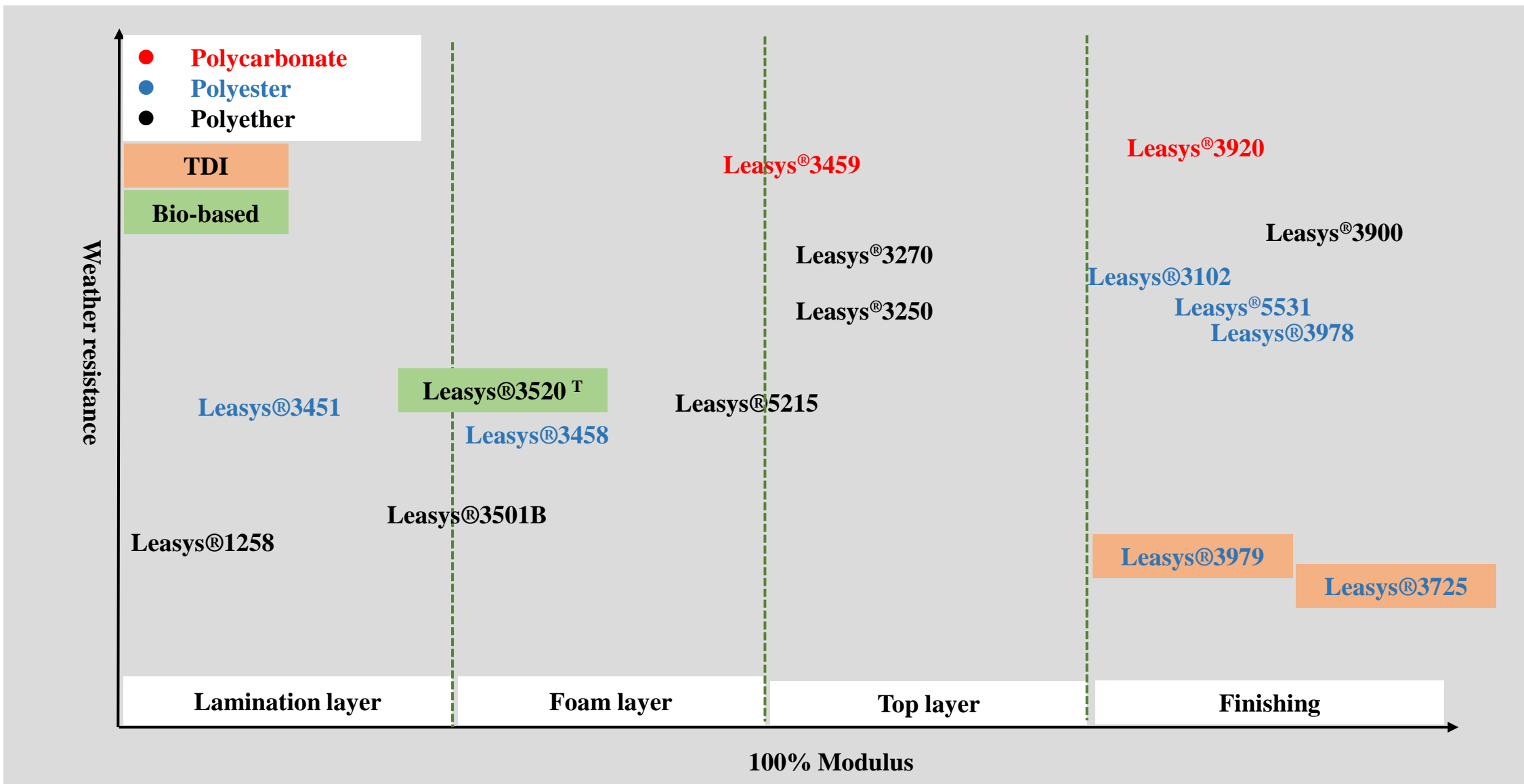
Features

- ✓ Simple process;
- ✓ Flat feeling;
- ✓ Excellent air permeability.
- ✓ Suitable softness;
- ✓ Good heat resistance;
- ✓ Cost-effective.



WB Microfiber process





Top layer		
Material	Weight/g	Specification
PUD	100	Wanhua
Pigment	8	
Silok 8030F	1	Wetting,Silok
BF2010	0.1	Defoamer,Silok
Silok 50	0.5	Feeling agent,Silok
Vesmody® U505	0.4	Wanhua
Aquolin® 166	0.5-1	Wanhua

Lamination layer		
Material	Weight/g	Specification
PUD	100	Wanhua
Silok 8030F	1	Wetting,Silok
Vesmody® U505	0.5	Thickner, Wanhua
Aquolin® 166	2-4	Hardner, Wanhua

Foaming/Intermediate layer		
Material	Weight/g	Specification
PUD	100	Wanhua
Pigment	0.3	
AMP95	0.5	DOW,pH adjuster
P112	4-8	Evonik, foam stabilizer
Kaolin/Fiber powder	10-80	Filler
Vesmody® A801	2	Wanhua
Aquolin® 166	1-2	Wanhua

- All the formula can be adjusted according to your application needs
 - Clothing, filler is about 10-30%
 - Luggage, filler is about 40-80%
 - Shoes, filler is about 20-40%

Luggage leather solution

Top layer: Scraping, WFT=0.15mm, 105-135°C, 7-15m/min

Foaming/lamination layer: Foaming ratio 750g/L, WFT=0.5+0.25mm, 105-135°C, 7-15m/min



Performance requirements

1. No crease or crease is easily recovery;
2. Stain resistance;
3. Appearance, high gloss;
4. Yellowing resistance;
5. Peeling strength (N/mm): ≥ 1 ;
6. High temp tack-free resistance : ≥ 4 level;
7. Embossing;
8. Jungle test (70°C, 95%RH) : >3 weeks;
9. Flex resistance: 23°C, 20,000; no crack.

Recommended solutions

Top layer: Leasys®3900&Leasys®3250

Foam layer: Leasys®3270

Lamination layer : Tekspro®3270

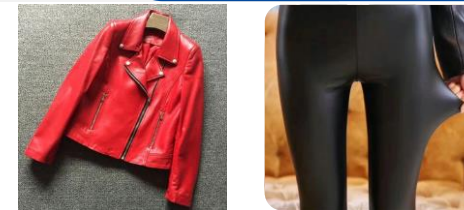
Item	Result
Cracking or not	NO
Thickness retention meets the requirement	Yes
Flex resistance (RT)	50000
Flex resistance (-10°C)	30000
Softness(hand-feeling)	OK
Martindale wear resistance	>50000
Jungle test (70°C,95%RH)	4 weeks
Peeling strength (N/mm)	Portrait: 1.5 transverse: 1.7

Clothing leather solution



Top layer: Scraping, WFT=0.15mm, 105-135°C, 7-15m/min

Foaming/lamination layer: Foaming ratio 500g/L, WFT=0.5+0.25mm, 105-135°C, 7-15m/min



Performance requirements

1. Peeling strength (N/mm): ≥ 0.5 ;
2. Jungle resistance (70°C, 95%RH) : 3 weeks;
3. Soft-feel, drape effect;
4. Dead fold and pressure mark resistance;
5. Water washing fastness ;
6. Color fastness :dry ≥ 4 level, wet ≥ 4 level;
7. High temp tack-free resistance: ≥ 4 level;
8. Flex resistance: 23°C, 100,000; no crack; -10°C, 25,000, no crack;
9. Wear resistance: martindale abrasion tester , 12MPa, 100,000,ok.

Recommended solutions

Top layer: Leasys®3900&Leasys®3250

Foam layer: Leasys®3501B

Lamination layer : Leasys®3501B(foaming paste) or Leasys®1258(dry paste)

Item	Result
Cracking or not	NO
Thickness retention meets the requirement	Yes
Flex resistance (RT)	>100000
Flex resistance (-10°C)	>25000
Resilience/Softness(hand-feeling) Score 1-5,5 is the best	5
Dead fold,25kg*24hrs,then observe after 24hrs	Recover 90% after 10min,recover completely after 90min
Jungle test (70°C,95%RH)	>4 weeks
Peeling strength (N/mm)	0.7
Water washing fastness 40°C*1200r*30min,5times	No delamination

Leisure shoes leather solution-Dry base



Top layer: Scraping, WFT=0.15mm, 105-135°C, 8m/min

Foaming layer: Foaming ratio 700g/L,WFT=0.75mm, 105-135°C, 8m/min

Lamination layer: WFT=0.16mm, 105-135°C, 8m/min

Performance requirements

1. Stiff, No crease or skinning ;
2. Scratch resistance , > 4 level;
3. Flex resistance: 23°C , 50,000 ; no crack ; - 10 °C , 30,000, no crack; wet, 50,000 ; no crack; ;
4. Peeling strength (N/mm) : wet ≥1.2,dry ≥1.0;
5. Dry process, high efficiency ;
6. Jungle resistance (70°C , 95%RH) : 5 weeks;
7. Wear resistance (martindale abrasion tester.12MPa) : dry, 51200 times,unworn; wet, 6400times, unworn.

Recommended solutions

Top layer: Leasys®3900&Leasys®3250

Dry paste lamination layer: Tekspro ®5215

Dry-base:Leasys®3270

Item	Result
Cracking or not	NO
Thickness retention meets the requirement	Foaming 0.6+0.7mm to 0.95mm
Flex resistance (RT)	>100000
Flex resistance (-10°C)	>50000
Wet flex resistance	>100000
Taber wear resistance,H18,750g,1000r	OK
Resilience/Softness(hand-feeling)	OK
Dead fold,25kg*24hrs,then observe after 24hrs	OK
Jungle test (70°C ,95%RH)	>5 weeks
Dry peeling strength (N/mm)	Portrait: 1.7 transverse: 1.2
Wet peeling strength (N/mm)	Portrait: 1.7 transverse: 1.1
UVB,30W,24hrs	5 level

Space shoes leather solution

Substrate: Impregnated non-woven fabric

Top layer: Scraping, WFT=0.15mm, 105-135°C, 6m/min

Foaming layer: Foaming ratio 750g/L, WFT=1.0mm, 105-135°C, 8m/min

Lamination layer: Dry paste, WFT=0.16mm, 105-135°C, 8m/min

Performance requirements

1. Stiff, No crease or skinning ;
2. Scratch resistance , > 4 level;
3. Flex resistance: 23°C , 100,000 ; no crack ; - 20 °C , 80,000, no crack;
4. Peeling strength (N/mm):≥3.5;
5. Dry process, high efficiency ;
6. Jungle resistance (70°C , 95%RH) : 5 weeks;
7. Hot cutting.

Recommended solutions

Top layer: Leasys®3250

Dry paste lamination layer: Leasys®1258

Dry-base: Tekspro®5215/Leasys®3459

Item	Result
Sticky or not after rolling up	NO
Fold skinning	NO
Flex resistance (RT)	>100000
Flex resistance (-20°C)	>100000
Dry rubbing, wet rubbing, sweat rubbing, each 100times; 95%Ethanol(10times)	All level5
Taber wear resistance,H22,1000g	>1000r
Jungle test (70°C,95%RH)	>5 weeks
Peeling strength (N/mm)	3.6
Peeling strength (N/mm) After soaking in 10% NaOH for 48hrs	3.5
Heat resistance,120°C*4hrs	Level4.5
UVB,30W,24hrs	level5

Performance requirements

1. Peeling strength (N/3cm) : ≥ 1 ;
2. Jungle resistance (70°C , 95%RH) :10 weeks ;
3. Yellowing resistance : > 4 level;
4. Color fastness : dry ≥ 4 level; wet ≥ 4 level;
5. High temp tack-free resistance: ≥ 4 level;
6. Flex resistance: 23°C , $\geq 100,000$ times, no crack , -20°C , 30,000 times, no crack;
7. Wear resistance : valspar abrasion tester, 100,000 times, no hole.

Recommended solutions

Top layer: Leasys® 3250

Foaming layer: Leasys® 5215

Lamination layer: Leasys® 1258

Item		Result
Peel strength/(N/3cm)	Warp	≥ 30
	Weft	≥ 30
Surface tack		Non-tacky
Light fastness	30W UV 4h	Not yellowing
Rubbing fastness	Dry rubbing	Over 4 grade
	Wet rubbing	Over 4 grade
Flex resistance	23°C	$\geq 100,000$ times
	-10°C	>25 000 times
Jungle test	70°C , 95%RH	5~10 weeks
Abrasion	Wyzenbeek	>100 000 times



Leasys® 3920 is an aliphatic polycarbonate waterborne polyurethane dispersion. It can be widely applied in high performance finishing agents and top layer of synthetic leather.

Archsol® 3920
Polycarbonate PUD

- *Excellent jungle resistance*
- *Excellent heat yellowing resistance*
- *Excellent xenon arc aging resistance*



Leasys[®] 3520^T is anionic aliphatic polyether-polyurethane dispersion, has 80% biological carbon content.

Leasys[®]3520^T

- *High bio-based carbon content*
- *Soft and elastic*
- *High filler content inclusive*
- *Excellent peeling performance*
- *Excellent dry, wet and low temperature flex properties*

Item	Value
Solid,%	48-50
pH	6-9
Viscosity, mPa·s	10-6000
Tensile strength,Mpa	15
Elongation,%	800
100% modulus, Mpa	1

Product overview for synthetic leather



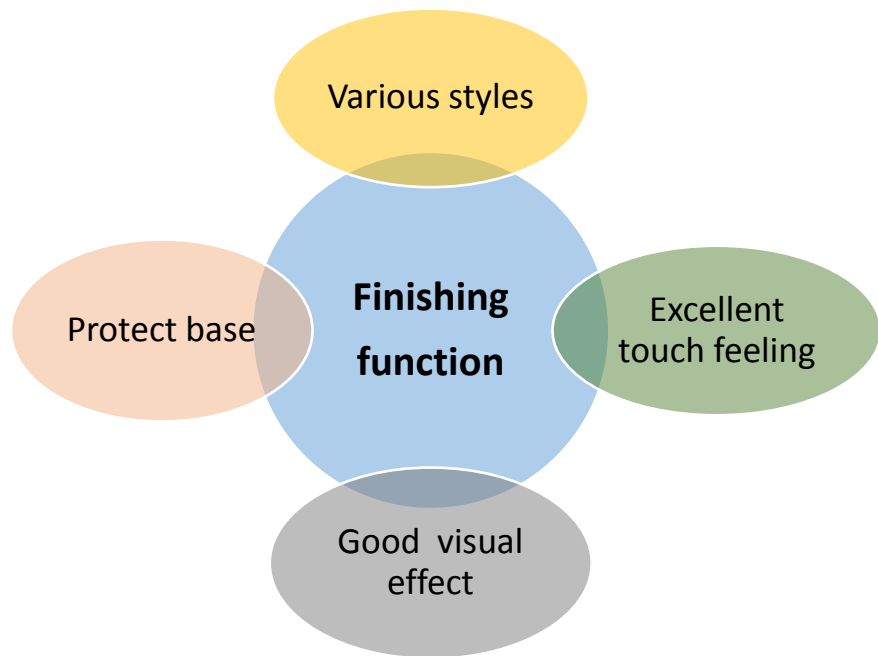
Product	REACH	Solids (%)	100% Modulus (MPa)	Properties			
					Lamination layer	Foam	Top coat
Leasys® 3250	√	30	5	Jungle test >10weeks, cold flexing, abrasion, alcohol resistance			●
Leasys® 3270	√	50	5	Cost-effective, Jungle test>10 weeks, cold flexing, abrasion, alcohol resistance			●
Leasys® 3900	√	38	16	Improve hardness , and wear resistance			●
Leasys® 3459	N	60	2.4	Excellent elastic		●	●
Leasys® 3458	√	50	2.5	Hydrolysis resistance,cold flexing,elastic		●	
Leasys® 5215	√	49	2.5	Jungle test> 10weeks, cold flexing, cost performance		●	
Leasys® 3501B	-	49	0.9	Excellent foaming stability, soft and elastic, withstand indentation and folding		●	
Leasys® 3520 ^T	-	49	1.0	High bio-based carbon content, excellent flex resistance		●	
Leasys® 1258	√	40	0.3	Soft handle, suitable for dry process	●		
Leasys® 3451	√	50	-	Excellent bonding strength and water resistance	●		
Leasys® 3920	X	33	6.5	Excellent jungle , heat yellowing resistance, xenon arc aging resistance			●

Product	Solid(%)	NCO(%)	Properties	Application
Aquolin®166	100%	22	Water dispersible isocyanate curing agent , longer pot-life	Universal types
Aquolin®161	100%	18	Good chemical resistance and long pot life,	Universal types



03

**Waterborne finishing
solutions**



Solvent-based



Water-based



Wanhua finishing solutions

PVC leather



Synthetic leather



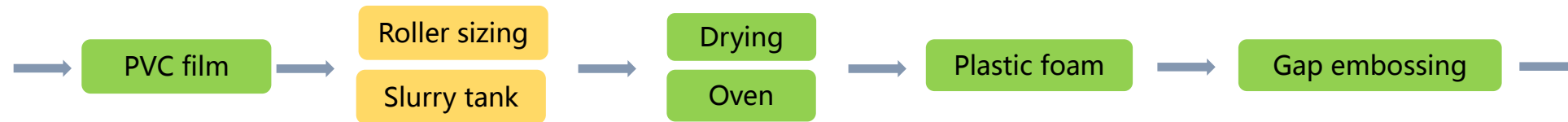
Finishing process of PVC leather

The preparation process of PVC leather includes *scrape coating*, *release paper* and *calendering* method .

The finishing process can be simply divided into three methods, as follows

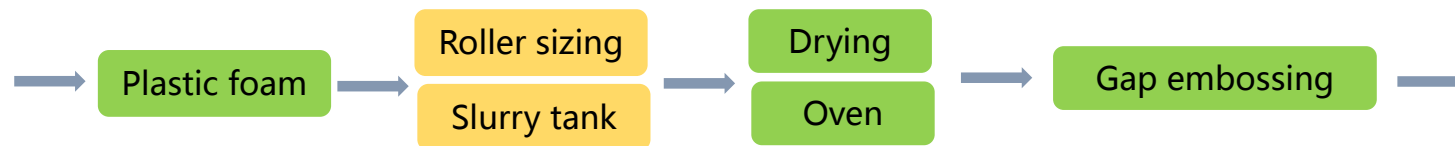
➤ Treatment before foaming

Features: Save material , better adhesion, high temperature resistance (230 °C, 3min). Follow-up can be further processed



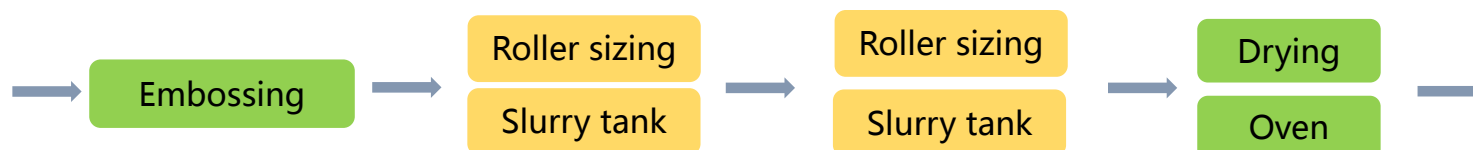
➤ Treatment before embossing

Features: Need more material , pattern and groove are easy to whitish, high temperature resistance (220 °C, 1min). Follow-up can be further processed



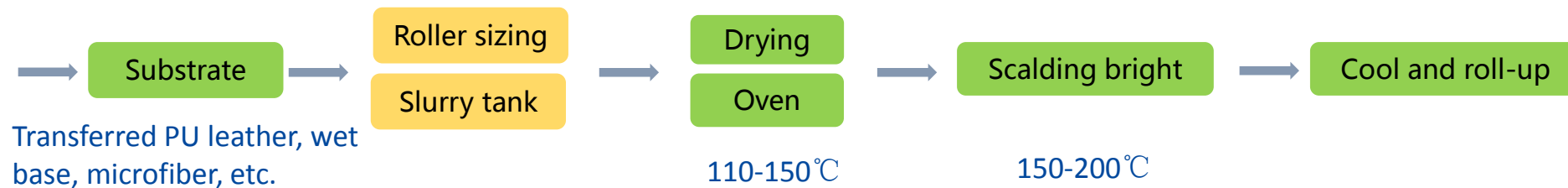
➤ Treatment after embossing

Features: Generally, it is processed twice, or it can be processed once



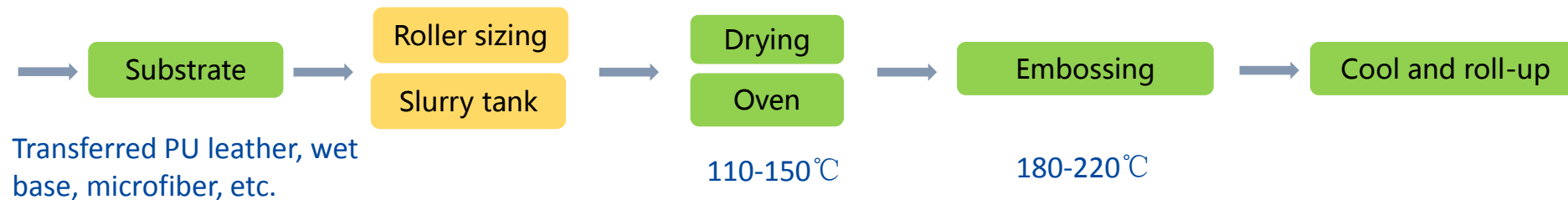
Finishing of PU leather includes high-gloss and matt, and its process are as follows

➤ High-gloss surface treatment



Requirement: High gloss and heat resistance. Partly needs good black brightness and yellowing resistance.

➤ Matt surface treatment



Requirement: Matte, heat-resistant embossing, good black haze

Suitable for genuine leather, synthetic leather, PVC leather . etc

Commercialized



High end: automotive interior area

Matte system

Leasys®3130

Self extinction, top coating

Leasys®T3977

Matte powder carrier, primer

Glossy system

Leasys®T3930

Pollution resistant resin, under development

Leasys®3920

Polycarbonate, film forming resin



Middle end: sofa leather, shoe leather, PVC plate Touch oil film, carboxyl group crosslinkable

Leasys®3102

Self extinction

Leasys®T3120

Leasys®5531

Alcohol resistance

Leasys®3900

High black brightness, not for PVC leather



Low end general market: bags and sofas

Leasys®3978

Leasys®3979

Matte powder carrier resin

Leasys®3725

Excellent adhesion to PVC

Vesmody®U609

High efficiency thickener, suitable for low solid content / high solvent system

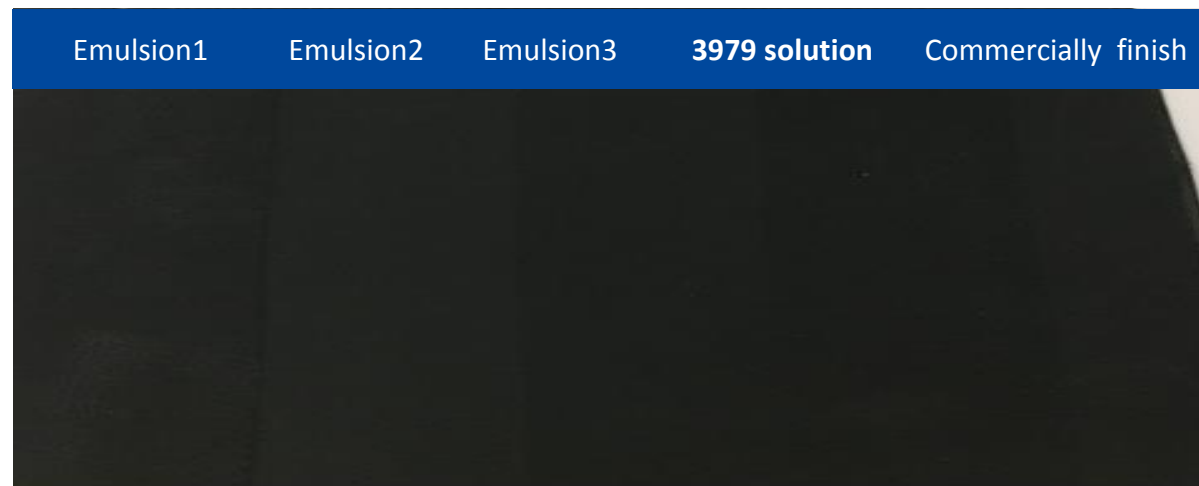
Luggage matt finishing solution for PVC leather

Leasys[®] 3979+Leasys[®] 3978

Substrate: Black PVC leather

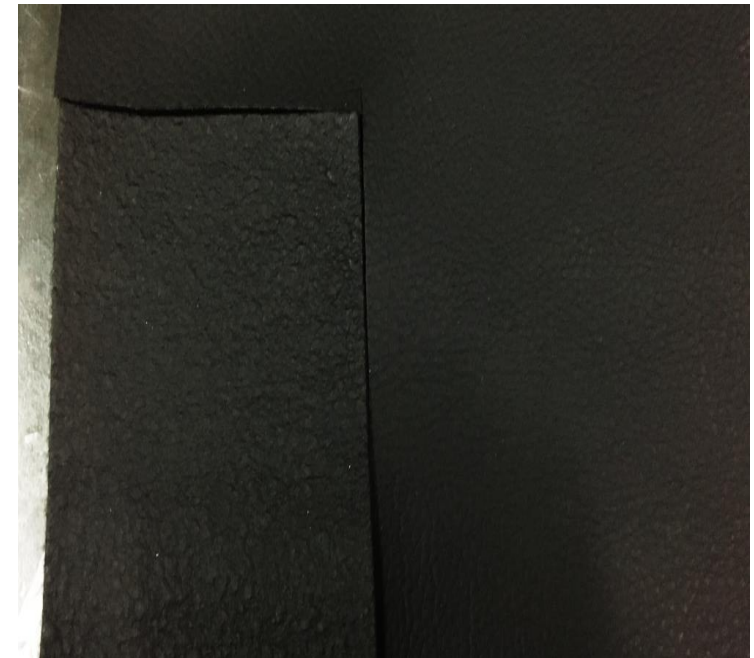
Process: Treatment before embossing , roll coating

□ Leasys[®] 3979 solution has excellent black haze



□ **Heat resistance:**

Surface doesn't turn bright (230°C , 90s)



□ **Anti-blocking**

Upper: Anti-blocking: level 5, no folding white(5kg*RT*24hrs)

Bottom: Anti-blocking: level 4, no folding white (5kg*80 °C*24hrs)



Luggage high gloss finishing solution for PVC leather

Leasys® 3725+Lacper® 4211

Substrate: Black PVC leather.

Process: Treatment before embossing , roll coating, 120 °C*1-2min

Item	Test method	Result
Black brightness	Visual	Black, bright
Adhesion	Fold, 25kg, RT, 24h	No adhesion, no whitening
Heat anti-blocking	Fold, 5kg, 80°C, 24h	No adhesion, no whitening
Flex resistance(RT)	RT, 100000 times	No damage, no whitening
Flex resistance(LT)	-20°C, 30000 times	No damage, no whitening
Heat resistance	230°C, 90s	Gloss doesn't change, no whitening

Product	Leasys3725	Lacper4211
Appearance		
Gloss/60°	37	35
Dry condition	130°C , 2min	

Formula for luggage high gloss finishing

Items	Weight/g	Supplier
Leasys® 3725	30	Wanhua
Lacper® 4211	20	Wanhua
H ₂ O	40.4	/
8030F	1.5	Silok
DMAC	6	Aladdin
NXZ	0.1	Basf
Vesmodity® U605	2.0	Wanhua

Formula for luggage matt finishing

Items	Weight/g	Supplier
Leasys® 3979	12	Wanhua
Leasys® 3978	12	Wanhua
H ₂ O	30	/
8030F	2.5	Silok
DMAC	6	/
BG	2	/
NXZ	0.3	Basf
S-401	4	Evonic
H ₂ O	29.2	
Vesmodity® U609	2.0	Wanhua

Leasys® 3102-Self Matt

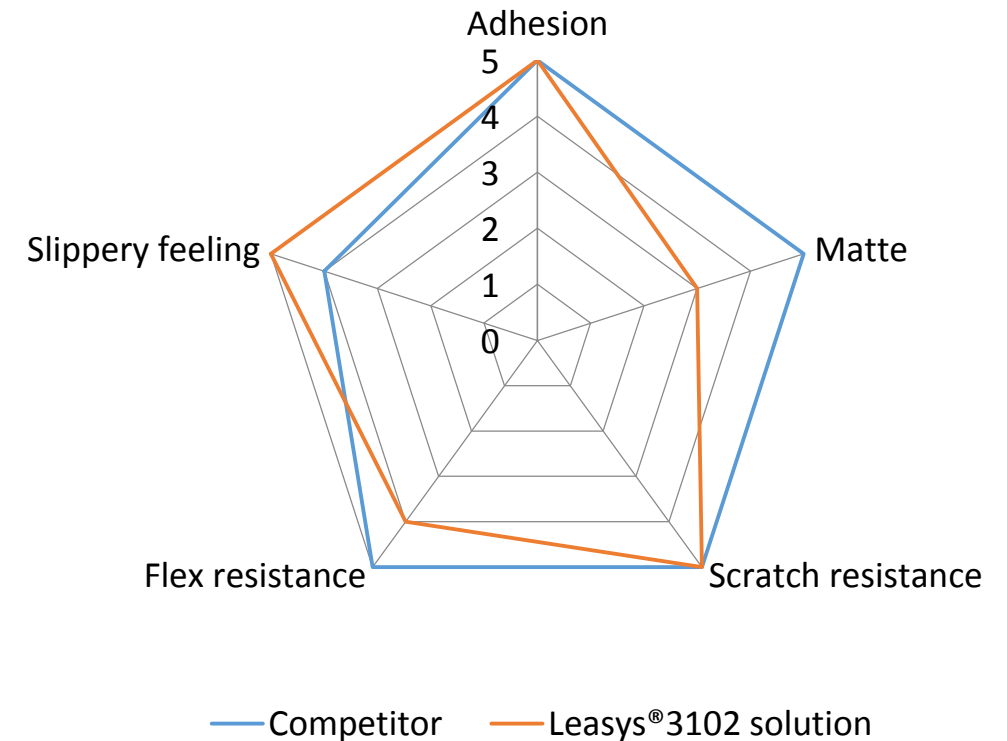
Substrate: Brown matte leather, has been pre-coated (10% solid waterborne emulsion+4% matt powder S401) and color modification (solvent-based PU)

Process: Treatment after embossing , roll coating 30g/m², 120 °C*1-2min

Material	Weight/g	Supplier
Leasys® 3102	24	Wanhua
Leasys® 5531	16	Wanhua
H2O	48	
DPNB	2	DOW
DPM	1	DOW
8030F	1	Silok
9155	3.0	Silok
3300	1	Silok
NXZ	0.1	Basf
S-401	1.6	Evonic
AMP95	0.1	DOW
Vesmody® A801	2.2	Wanhua
Aziridine	1	

Property requirements

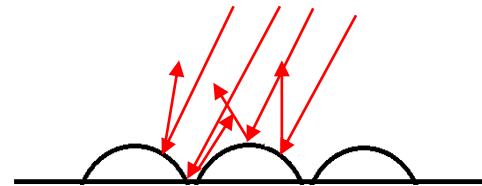
- Adhesion: do not fall off by hand scraping;
- Scratch resistance: No traces after nail scratching;
- Hand sweat resistance: No trace after touching hard by finger;
- Flex resistance: 100,000 times at room temperature.



Leasys® 3102-Self Matt

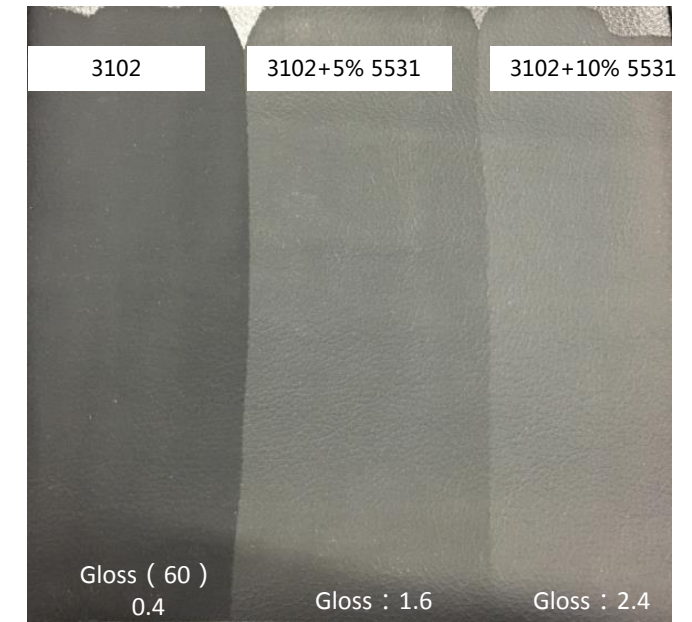
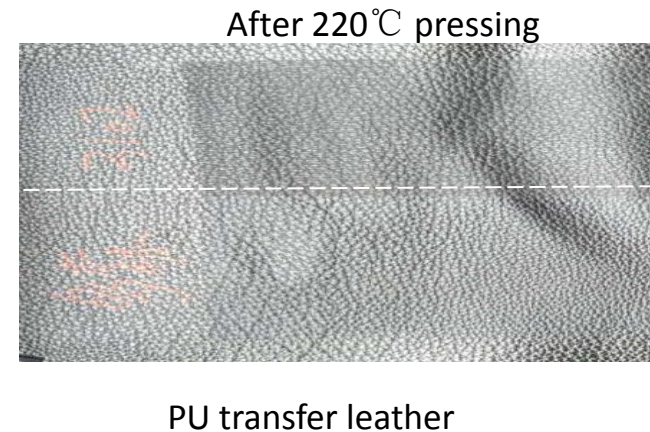
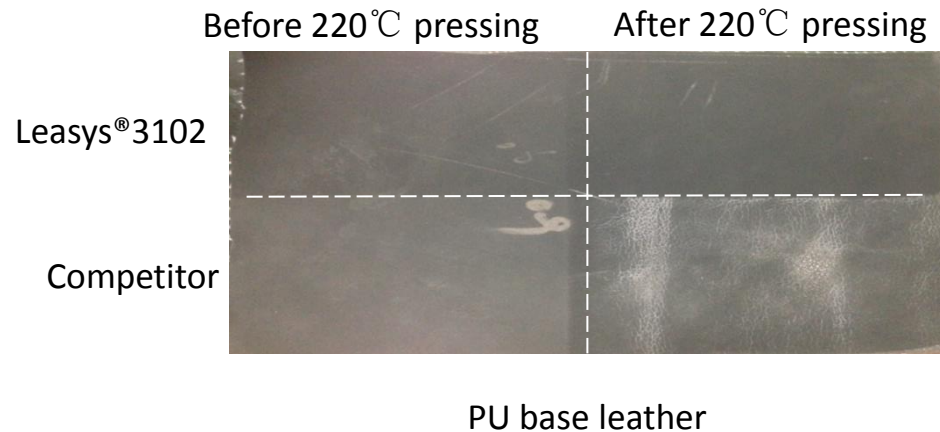
Performance:

- ✓ No additional matting powder, no extinction angle
- ✓ High matte ,no uneven shine after friction
- ✓ Feel smooth



d (Partical Size) =1-2um
Rough Surface form diffuse reflection







Process: Roll coating, 150 °C*1-2min,
press,6-8s,220°C



➤ Leasys®3102 has excellent black haze and heat resistance

Leasys® 3900

- ✓ Excellent black brightness
- ✓ Maintain a very good black effect after roll coating
- ✓ Excellent heat resistance, 120 °C, 7 days, black brightness has no obvious change
- ✓ Excellent moisture and heat resistance, 70 °C, 95%RH, 4 weeks, black brightness has no obvious change

Product	5531	3900	5531	3900	5531	3900
Appearance						
Gloss/60°	9.5	9.16	7.48	8.2	7.67	12.08
Dry condition	20°C , 1min		80°C , 1min		150°C , 1min	

➤ Under the condition of high temperature, Leasys® 3900 has better black brightness

Leasys® 3102-Self Matt

Formula for clothing/luggage matt finishing

Material	Weight/g	Supplier
Leasys® 3102	93	Wanhua
Leasys® 5531	5	Wanhua
Silok 8000	0.5	Silok
Silok 8488	0.5	Silok
Silok 9166	1	Silok
NXZ	0.1	Basf
Vesmodity® U300	0.5	Wanhua
Vesmodity® U609	0.5	Wanhua
Aquolin® 161	2-4	Wanhua

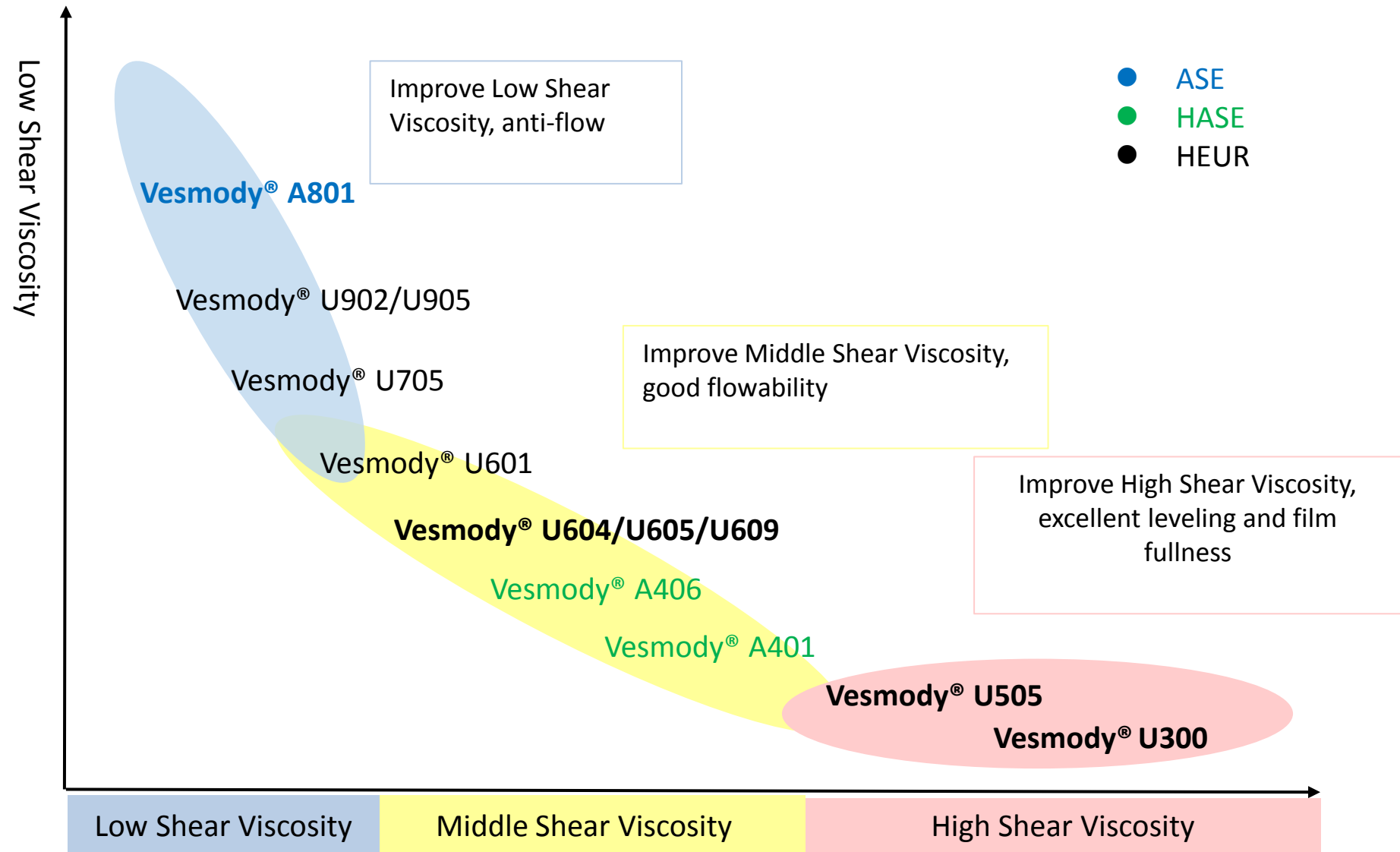
Formula for clothing/luggage high gloss finishing

Material	Weight/g	Supplier
Leasys® 3900	91.5	Wanhua
Silok 8000	1	Silok
DPNB	2.5	DOW
DPM	1.5	DOW
Silok 9166	1	Silok
NXZ	0.1	Basf
H ₂ O	1.4	
Vesmodity® U300	0.5	Wanhua
Vesmodity® U605	0.5	Wanhua
Aziridine	0.5-1	

Waterborne finishing product overview



Product	Type	Reach	Solids (%)	100% modulus (Mpa)	Elongation (%)	Tensile strength (Mpa)	Property
Leasys® 5531	Aliphatic/polyester	Y	35	12	400	50	Solvent free, good alcohol resistance
Leasys® 3102	Aliphatic/polyester	Y	35	--	--	--	Special black fog / self extinction, alcohol resistance, 230 °C 90s PVC pretreatment resistance
Lacper® 4211	Aliphatic/Polyether	Y	40	--	--	--	High gloss, excellent heat blocking resistance
Leasys® 3725	Aromatic/Polyester	-	40	20	250	40	High gloss, excellent adhesion on PVC and PU, good sticky resistance
Leasys® 3920	Aliphatic/Polycarbonate	N	33	6.5	400	50	Excellent jungle , heat yellowing resistance, xenon arc aging resistance
Leasys® 3900	Aliphatic/polyether	Y	38	18	290	38	High black brightness, not for PVC leather
Leasys® 3978	Aliphatic/Polyester	Y	40	16	360	35	Low end, excellent matte powder carrier resin, good adhesion
Leasys® 3979	Aromatic/polyester	Y	40	5	360	33	Low end, excellent matte powder carrier resin, high cost performance





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