

2K – Two component PU SYSTEM

Technical information.

The Two-component System is the latest generation of synthetic leather production techniques, far surpassing conventional materials in terms of physical, chemical and sensory performance.

The Injection system is made up of two main tanks named A and B which contains:

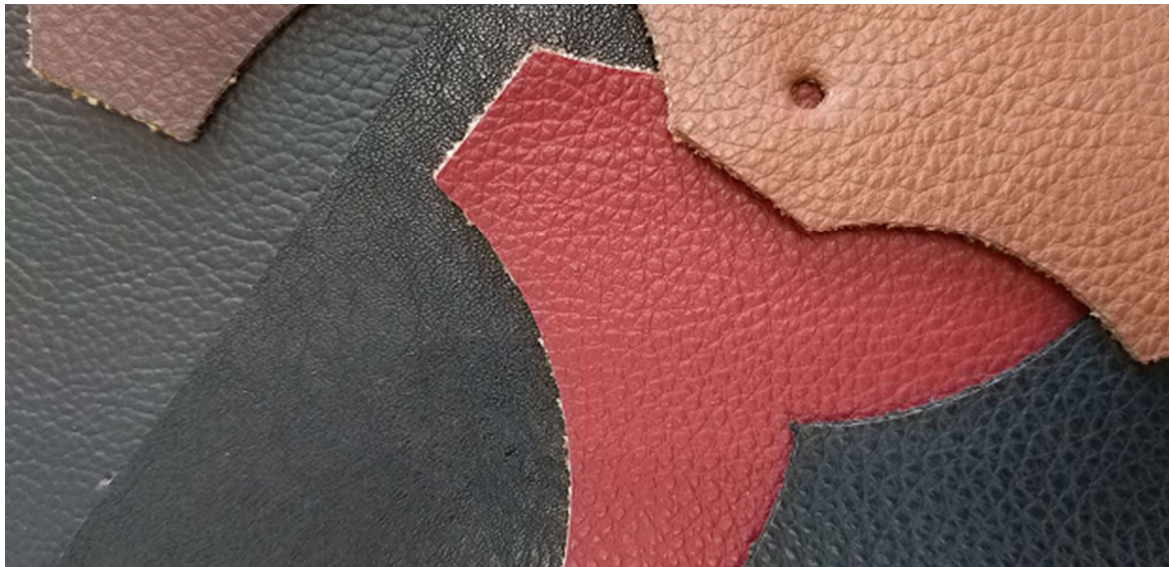
- A- Isocyanate (MDI)
- B- Polyol.

The reaction of joining this two materials results into a solvent free polyurethane paste which accordingly coated by a conventional coating head on the release paper becomes a solvent free layer of Polyurethane. Since it is solvent free it means that it doesn't suffer any evaporation during the curing process into the oven

By mixing the components, a foaming chemical reaction occur, and the coated layer increase the volume from 1,5 times to 2,5 times, depending the modulus of the selected system.

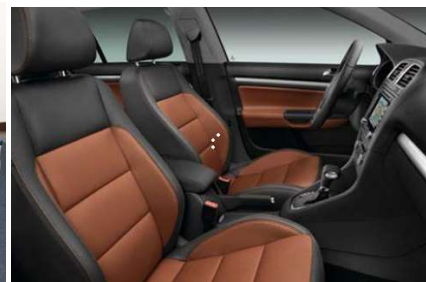
High Modulus 70-80, which is harder hand feeling, Increase the volume 1,5 times from wet application.

Low Modulus 30-40, which is soft hand feeling, increase the volume from 2 to 2,5 times the original volume.



MAIN ADVANTAGES:

- By using the proper backing base, flame retardant and proper finishes it is possible to reach the highest standards required by the most demanding industries as:
 - o Public transportation seats
 - o Car seats
 - o Train seat
 - o Aircraft seat
- Since the coated thickness is much more thicker than traditional PU, and also the PU layer is pure polyurethane and not a solution which needs to be modified by drying the solvent, it make the final synthetic leather acquire a high abrasion resistance. This property make the material suitable for
 - o Shoes industry
 - o Garment
 - o Sofa and upholstery
 - o High quality bags
- The physical, chemical and sensory performance match extremely the properties of the real leather, but by a much lower cost. This product must be compared with real leather, not with other synthetic materials.
- This kind of material can be finished by printing process same as the regular synthetic leather, BUT CANNOT BE EMBOSSSED due the nature and high elasticity of the resulting PU foam.
- The PU Injection unit can be added into a regular coating line with 4 ovens and fabric lamination before the last oven, because the production process is almost the same as regular PU or PU/PVC. The weak point of doing in this way is that the production speed will be reduced seriously because the two component needs more exposition time through the oven to be totally cured. It needs three times the necessary time which needs any regular PU product to be produced. For solve this situation our engineers designed a three stages oven from 45 to 125m length, which makes the process run as fast as any regular PU/PVC process.
- Hydrolysis resistance much higher than coagulated PU. From 5 years guarantee.



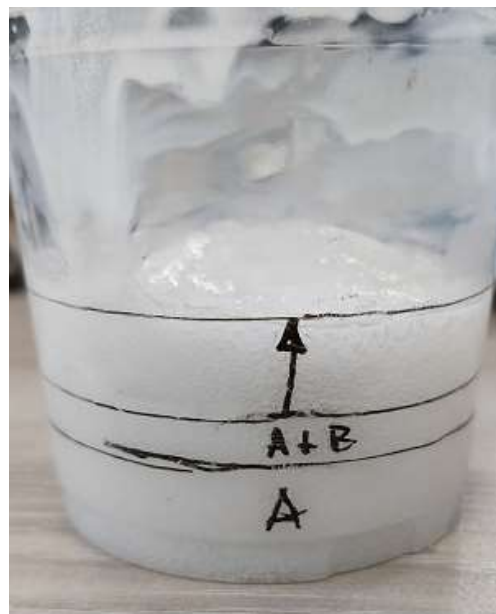
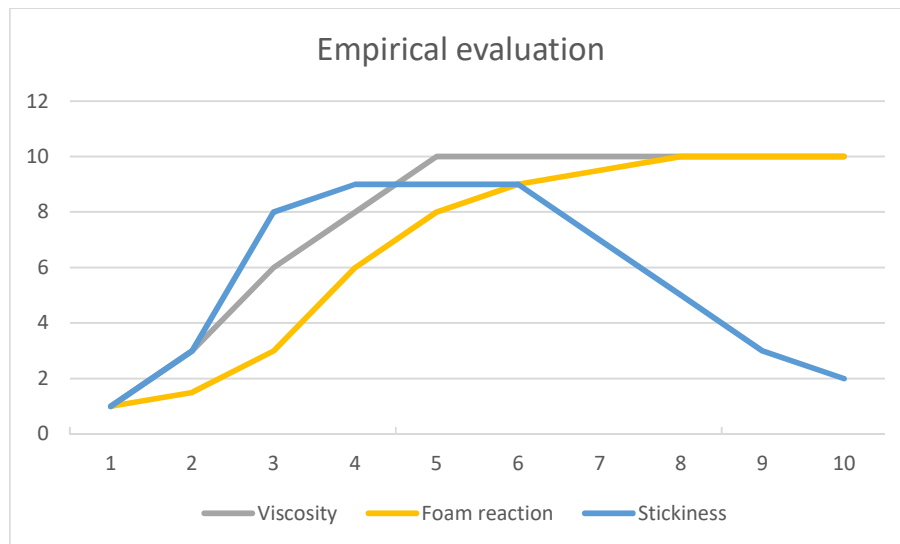
Laboratory experience:

In the following chart is possible to have a barely idea about the behavior of the 2 components once mixed between each other's.

In the x axis is shown minutes from the mixing moment to the final reaction.

In the y axis is shown an appreciation from 1 to 10 where 1 mean low or minimum and 10 means high or maximum.

This charts is referred to an experience **by handling the raw materials under ambient temperature**, that's why the reaction and foaming times shows are long.



Middle hardness system

Handling in laboratory, step by step:

On the surface of release paper sample is coated 0,15mm of semi hard PU skin resin. On this skin will be coated by hand the second layer of 2K system.

- 1- A COMPONENT IS THE REFERENCE FOR 100%
 - a. **Step 1:** add catalyst 1 into the component A (0,3%)
 - b. **Step 2:** add catalyst 2 into the component A (0,1%)
 - c. The mix results into Component A already including the Catalyst combination. This mixing is made automatically by the machine during production. Component A still looks stable, no reactions at view.
- 2- B COMPONENT
 - a. Depending the Modulus selected is the required System. Every system must be used in its own proportion between component A and B. I case of the present experiences the middle Modulus was selected
 - b. **Step 3:** 62% of B component (from 100% of A Component) is mixed with A component from step
- 3- TWO COMPONENT MIXED.
 - a. **Step 4:** Coated 0,3mm by metallic bar on the skin layer already dry
- 4- SEMI-DRY:
 - a. **Step 5:** 30/ 60 seconds under 100~110°C
- 5- BASE LAMINATION:
 - a. **Step 6:** The surface of 2K result at this moment into a sticky surface but already with viscosity high, the material already got solid from the initial semi-liquid state.
 - b. The lamination must be done by pressing. No need temperature, just high roller pressure.
- 6- CURED:
 - a. **Step 7:** to finalize the reaction which will result into a PU foam, and to get the PU completely cured is necessary to keep at least during 5 minutes under 130~140°C



Pictures of the pilot equipment used to develop the technology – (2016-2018)



Injection unit – raw material tanks



Injection unit – mixing and auto-feeding device



PRODUCTION MACHINE.



Coating head with automatic feeding unit.



Complete storage and feeding tanks units



Overview of the full injection unit.

INJECTION MACHINE

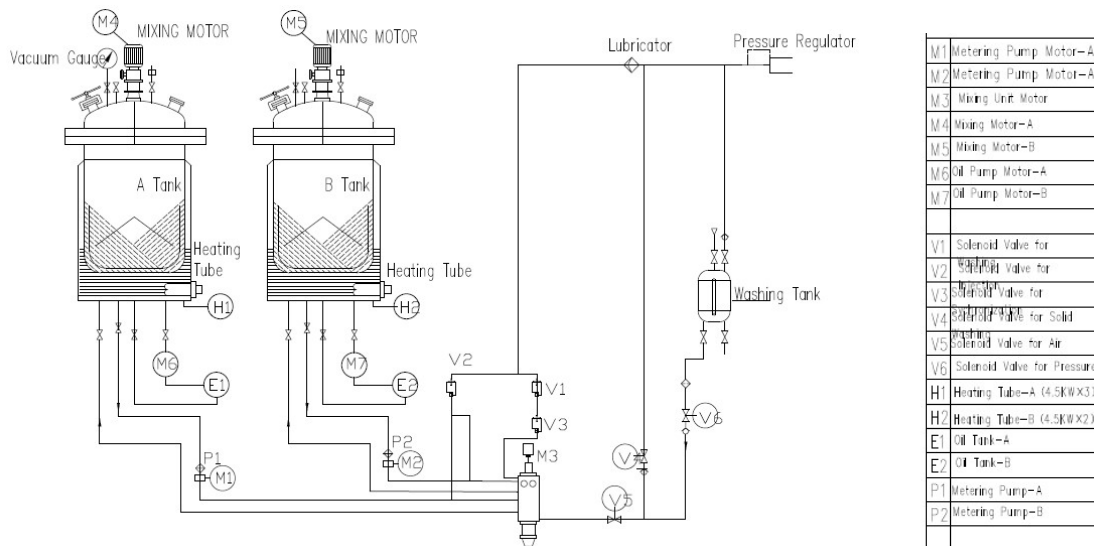
The complete injection system is integrated by several devices which the main purpose it to storage, feed, mix and inject A and B component and Catalys by making “on line mixing”. Also, the system includes the necessary equipment to run “self-cleaning process” when necessary.

Two tanks contains the A and B products separately. This tank are made by stainless-steel and heated by a hot oil cicuit which keep the raw materials inside in a stable temperature and viscosity to ensure the accuracy of the injection system. One more small tank contains the catalyst.

Since the 2K PU system start its reaction once mixed the two components, the injection machine is equipped with accurate pumps operated by servo mortors, to ensure the exact proportion of each component at the moment of make the production.

Both component are driven through high presure hoses until the injection head, located in an automatically moved trolley over the release paper and before the coating knife. In this place, the two component gets mixed by a high speed and high precission mixer included in the noozle spout. The injection is made directly on the release paper, without any human intervention. The feed of the A and B components can be adjusted by touch sreen HMI (Human Machine Interfase) and it is controlled by PLC.

The accurate of the mixing and the short time between the injection and the coating becomes into the heart of the process to make high quality 2K materials.



Our factory is proud to be the first company to develop the proper machine to mix and coat “on line” the 2K PU technology system. According to the needs of our customers we can supply the injection device, which can be adapted into conventional coating lines, and we also design and construct special machines adapted to reach high speed production.

Final product cost comparison.

Theoretical cost calculation to produce 1,0mm of synthetic leather by three different techniques, which means to get similar material at sight, but completely different technically.

1- Normal DRY PU synthetic leather

Step	Raw material	Cost USD Fob China	Application	Usd
1 st coating head – pre skin	HP-6150 + DMF/MEK	1,25 /kg	0,085 kg/m	0,107
2 nd coating head – skin	HP-6090 + DMF/MEK	1,25 /kg	0,200 kg/m	0,250
3 rd coating head - Binder	HP-750HV + DMF/MEK	1,50 /kg	0,085 kg/m	0,127
Backing *	Raschel fabric coagulated 1,00mm final thickness.	1,50 /m	1m	1,500
PU release paper	USD9000 TON / 120000m	0,075/m	1m	0,075
Energy	No data			
Labor cost	No data			
TOTAL COST OF RAW MATERIAL TO PRODUCE 1 METER				USD 1,915

*This kind of PU leather is not “solvent free” because the PU coagulated base always have some small waste of solvent remaining from its own production process. It is not because the PU used for coating contains solvent.

2- 2K Synthetic Leather (FREE SOLVENT 2 COMPONENT SYSTEM)

Step	Raw material	Cost USD Fob China	Application	
1 st coating head – pre skin	HP-6150 + DMF/MEK	1,25 /kg	0,085 kg/m	0,107
2 nd coating head – skin	HP-6090 + DMF/MEK	1,25 /kg	0,200 kg/m	0,250
3 rd coating head - 2K INJECTION	A+B+ CATALYST	4,00 /kg	0,28 kg/m	1,120
Backing –	Raschel fabric, 140gs/sqm	2,70 /kg	0,21 kg	0,580
PU release paper	USD9000 TON / 120000m	0,075/m	1m	0,075
Energy	No data			
Labor cost	No data			
TOTAL COST OF RAW MATERIAL TO PRODUCE 1 METER				USD 2,130

3- PU/PVC

Step	Raw material	Cost USD Fob China	Application	
1 st coating head – pre skin	HP-6150 + DMF/MEK	1,25 /kg	0,085 kg/m	0,107
2 nd coating head – skin	HP-6090 + DMF/MEK	1,25 /kg	0,200 kg/m	0,250
3 rd coating head - PVC foam	PVC FOAM	1,60 /kg	0,55 kg/m	0,880
4 st coating head – PU binder	HP-750HV + DMF/MEK	1,5 /kg	0,085 kg/m	0,127
Backing –	Raschel fabric, 140gs/sqm	2,70 /kg	0,21 kg	0,580
PU release paper	USD9000 TON / 120000m	0,12/m	1m	0,12
Energy	No data			
Labor cost	No data			
TOTAL COST OF RAW MATERIAL TO PRODUCE 1 METER				USD 2,064