Hot melt adhesive for the flocking process

Presented below are the results of recent tests conducted in cooperation with the adhesive manufacturer Novotex. Using the advanced adhesives Neoflex (which belongs to the Novotex Group), Aigle carried out new tests on flocking processes with very interesting results.

- **BRIEF INTRODUCTION TO HOT-MELT PUR ADHESIVES**

  Hotmelt PUR reactive adhesives are polyurethane adhesives formulated with internal crosslinker locked in the absence of moisture, in vacuum and in the presence of nitrogen.
  In industrial applications, the adhesive is freed from its wrapping and pressed with a hot pressing plate fully adhered to the inside wall of the drum, then fed into heated tubes to the nozzles and holding tanks, and then applied with dot-dye application by engraved cylinders (Rotogravure) (see figure 1), or with full surface coating by Slot-Dye application (see figure 2).
  The cross-linking action is developed by temperature, air and humidity. Once applied, these adhesives cross-link with air humidity and after approximately 48 hours (depending on ambient conditions and air humidity) form a permanent and irreversible bond to the substrate and fibres. This guarantees the non-reactivation of the adhesive by ensuring resistance to high temperatures, hydrolytic action and washing, without delamination on the coated substrate.

- **HOT MELT PRETESTING AND APPLICATION TO FLOCKING PROCESSES**

  In 2007, during the 19th Int. Flock Symposium Arne Voigt, a research associate at the Institute of Textile and Clothing Technology of the TU Dresden, presented an interesting study on 'The use of hot melt for flocking automotive parts with the aim of having all components made of the same polymer'.
  The study came to the conclusion that 'flocking is technically feasible with hot melt adhesives. The surface quality obtained is very good and is characterised by a high flocking density and good abrasion resistance'. So, in essence, the theoretical part of the research was mostly done.
  However, having considered the possibility of using this type of adhesive in the flocking process, we can highlight two new interesting aspects:

- After 2007, we have never encountered an industrial flocking application with hot melt adhesives. This, of course, does not mean that no flocker uses hot melt adhesives, but as flocking line manufacturers, we have never seen this type of application in operation.

- The second part of the conclusions of the 2007 study states that: "Based on further process modifications and further developments, the amount of hot melt adhesive, the energy requirement and the processing time required need to be reduced". This is an important aspect of the hot melt application system that will be the subject of the following analysis.

- **A NEW RECENT TEST IN COLLABORATION WITH NOVOTEX**.

For years, Aigle has been producing hot melt applicators for coating and laminating lines and we got in touch with Novotex, proposing to collaborate on new hotmelt application tests with its adhesives.
We conducted several tests at the Novotex laboratories.
Novotex suggested we use NEOTHERM PU-3550.1 adhesive and
We tested it with different media while keeping the application temperature as low as possible (we never exceeded 120°).
We tested this adhesive with the following media:

PU foam (see photo #3)
Transfer paper (see figure #4)
Pvc (see photo #5)

With the application, we achieved a dry weight of adhesive of between 40 and 60 g/sqm. On transfer paper and pvc we coated the backing directly; on the PU foam we applied the adhesive film using transfer technology, first we applied the adhesive film to the release paper and then transferred it to the foam.

At Novotex, we used a laboratory film applicator adhesive coating, which involves a hot plate where the substrate is placed; the principle of adhesive application on a heated surface, with a melting gun extruding a bead of adhesive. Both devices are used with a preset temperature (see figure #6). An interesting point for possible future industrial processes is the application technology. We believe that the use of a high-precision slot-dye may be the optimal solution to obtain a uniform and constant film, which is necessary for the good result of the flocking process (see figure #7).

- **THE RESULTS OF THE TESTS PERFORMED**

We achieved very good results with all the media tested.
The flocked substrates are tested with the Martindale abrasion resistance test. The results obtained are excellent. With the PVC backing, we obtained a resistance of 100,00 cycles.
We were also impressed by the soft touch of the flocked film split from the release paper and, in general, the good density and solidity of the flocked surface.

- **STRENGTHS OF THE HOT-MELT ADHESIVE IN THE FLOCKING PROCESS**:

Greater sustainability - Smaller flocking line (no oven required)

In fact, a flocking line with hot-melt glue application is much shorter and consumes less energy than a conventional line. (see figure #8). The absence of an oven can have a strong impact on the trend towards reducing energy consumption, a goal of many industries.
Another important issue for a better sustainability of the flock process will be achieved when we demonstrate that the flock fibres incorporated in the hot melt adhesive can create stronger bonds between materials: this could lead to products with a longer lifetime. Longer-lasting products reduce the frequency of disposal and the demand for raw materials, thus promoting a more sustainable life cycle.

Good performance

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The obtained flocked surface quality is very good and is characterised by 'high flock density and excellent abrasion resistance (up to 100,000 cycles in the Martindale test performed in Novotex) (see figure #9).

Improved recyclability,
This is a very interesting aspect, especially in the automotive sector. Hot-melt adhesives release minimal residues compared to other types of adhesives. This reduces the likelihood of contamination during recycling and can lead to higher quality recycled materials.

- **WEAKNESSES OF HOT-MELT ADHESIVE IN THE FLOCKING PROCESS**

Scope of application in flocking processes

At present, we know that hot-melt adhesives are only applicable on flat or slightly curved surfaces, but not on 3D objects.

Application temperatures

120° C may not be a suitable temperature for all substrates.

Cost of hot-melt adhesives

PUR prices are even higher than the common industrial adhesives currently in use.

Search

More research is still needed to reach the point where hot-melt adhesive will be considered a viable and reliable alternative to water- and solvent-based adhesives.

- **CONCLUSIONS:**

Studies have shown that hot melt adhesive could in the near future at least become a possible alternative as an adhesive with the right characteristics to achieve good performance in use for the flocking process, in order to meet the ever-increasing demands for a more sustainable future. Aigle - with innovative plants - and Novotex - with PUR adhesives - are ready to take up the challenge of the future.

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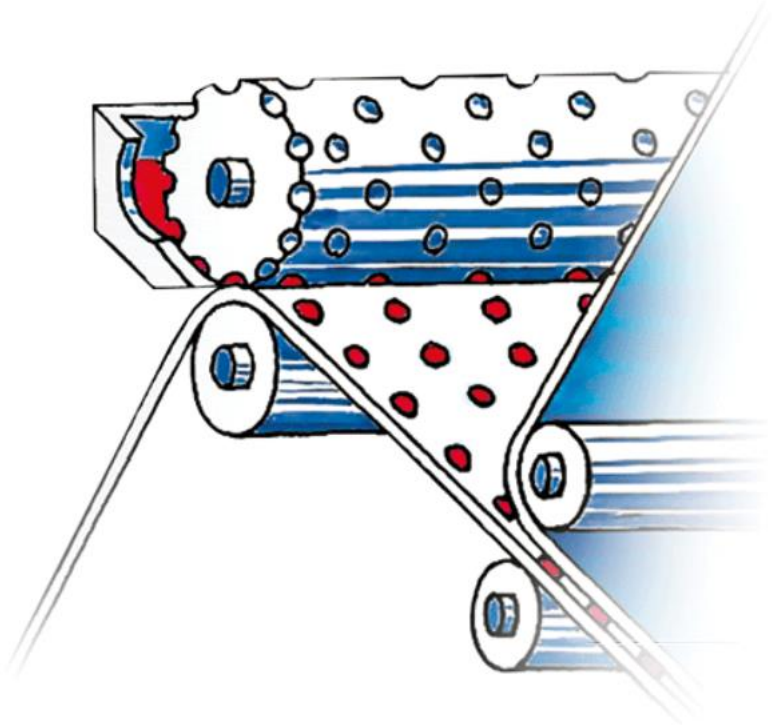


Image #1 - Dot application using engraved cylinders

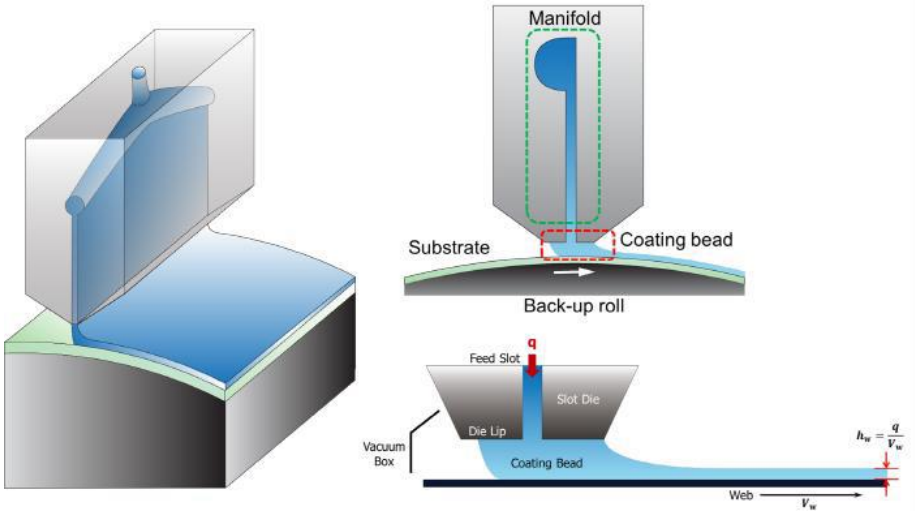


Image #2 - Application with Slot-Dye

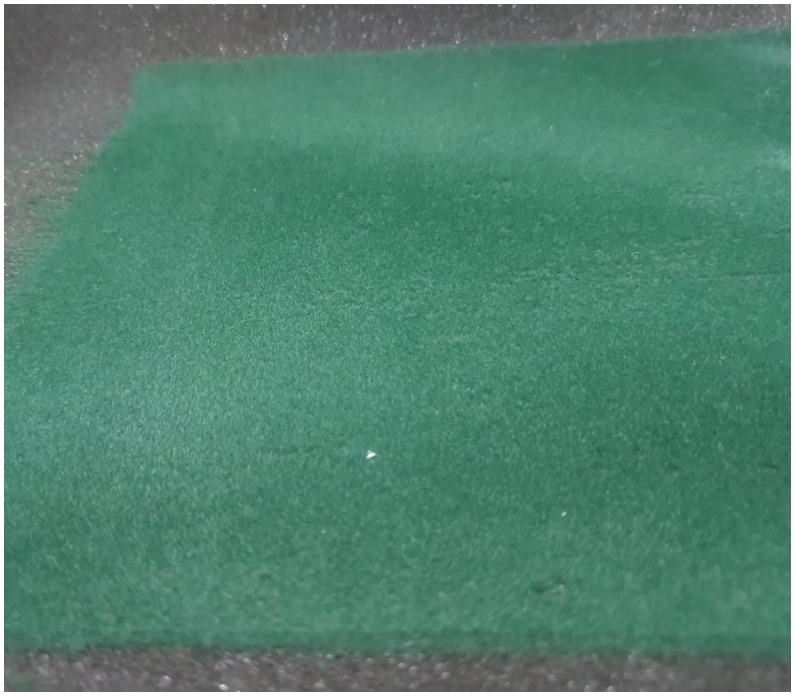


Image #3 - PU foam

Image #4 Tranfer paper

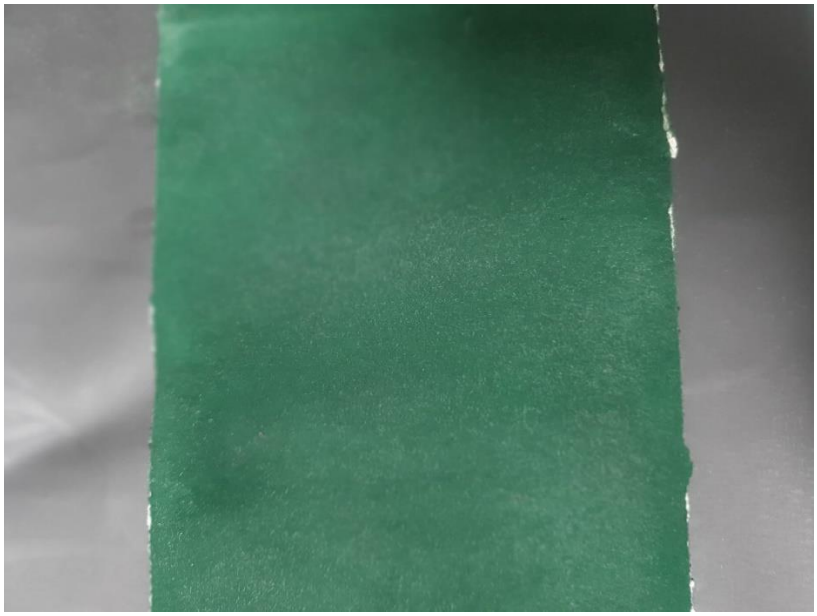


Image #5 - Pvc

Image #6 - Laboratory film applicator

Image #7 - Application with industrial Slot-Dye

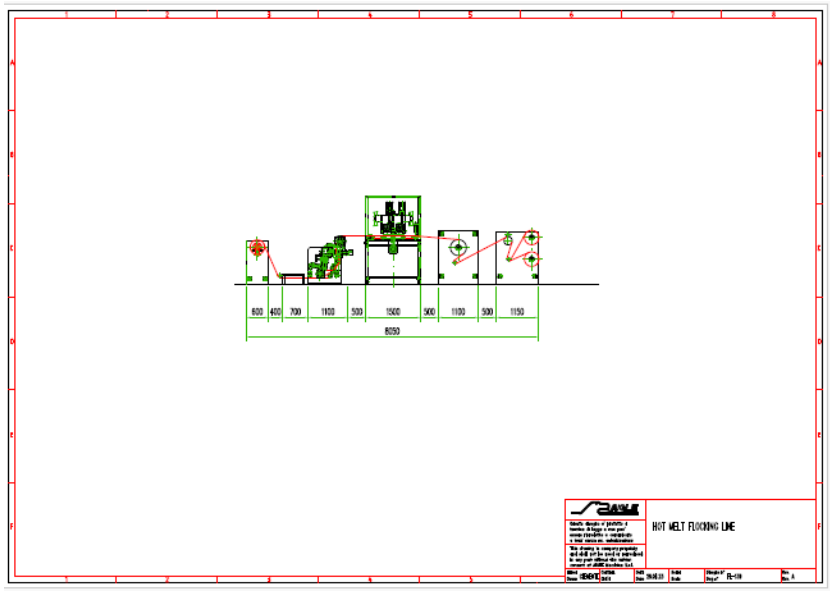
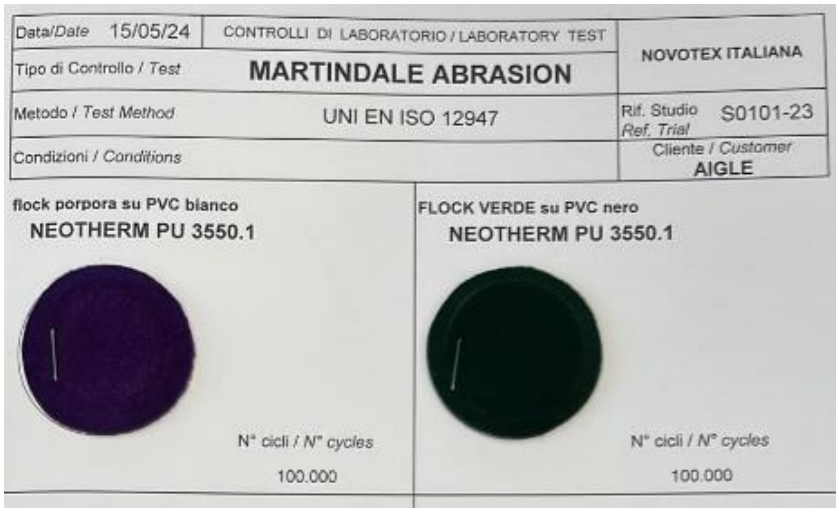


Image #8 - Hot melt flocking line



Data/*Date* 15/05/24	CONTROLLI DI LABORATORIO / LABORATORY TEST	NOVOTEX ITALIANA
Tipo di Controllo / *Test*	**MARTINDALE ABRASION**	
Metodo / *Test Method*	UNI EN ISO 12947	Rif. Studio / *Ref. Trial* S0101-23
Condizioni / *Conditions*		Cliente / *Customer* AIGLE

flock porpora su PVC bianco NEOTHERM PU 3550.1	FLOCK VERDE su PVC nero NEOTHERM PU 3550.1
N° cicli / *N° cycles* 100.000	N° cicli / *N° cycles* 100.000

Image #9 - Martindale abrasion resistance