Title: PROCESS FOR SUBLIMATION TRANSFERRING A PATTERN ON POLYURETHANE SURFACE AND POLYURETHANE PRODUCT TRANSFERRED THEREFROM

Abstract: This invention relates to a process for sublimation transferring a pattern on polyurethane surface and polyurethane products transferred therefrom. When a wet-dry or dry polyurethane surface was subjected to sublimation transfer the polyurethane surface adhered to the transfer paper due to the elevated temperature. Thus it was impossible to separate the polyurethane surface from the transfer paper. To solve this problem of the prior art, one-component polyurethane is mixed with solvents to make the mixture a liquid, and drying it gives polyurethane products. As shown in Figure 5a, the polyurethane surface can be easily separated from the transfer paper.
PROCESS FOR SUBLIMATION TRANSFERRING A PATTERN ON POLYURETHANE SURFACE AND POLYURETHANE PRODUCT TRANSFERRED THEREFROM

Field of the Invention

This invention relates to a process for printing wet-dry or dry polyurethane products. Specifically, this invention relates a process for printing color fades or various patterns on the surface of polyurethane products and printing on wet-dry/dry polyurethane products.

Background of the Invention

Conventionally sublimation transfer means a digital printing method combining the printing and the dying processes, comprising of the following process: adhering to the matter-to-be-transferred, the transfer paper printed with the transfer ink without a plate making process, and then thermal compressing at a temperature of 160°C to 220°C under predetermined pressure. By this thermal compression step the ink on the printed transfer paper, as well as the dye in a vaporized gas infiltrated into pores on the surface of the matter-to-be-transferred, may be vaporized at an elevated temperature without going through a liquid state. When cooling the temperature down again the vaporized dye infiltrates the surface of the matter-to-be-transferred to remain therein as a foreign polymer material. Thus, the result is a solid surface without protrusions or layered structures.

Because the sublimation transfer is carried out at an elevated temperature over 180°C, it can only be applied on material such as those products made out of polyester roll-stock, glass, or paper which can withstand high temperature. The low heat resistance products such as polyurethane cannot be subjected to the sublimation transfer process.

When polyurethane (hereinafter referred as ‘PU’) products are transferred by the sublimation transfer process the transfer paper and PU cannot withstand an elevated
temperature. Because of this the transfer paper fails to be separated from the surface of PU as shown in Figure 5b. The failure of the transfer paper to be separated from the PU is because PU melts at 180°C or greater over the period of about 20 seconds. Thus, it is impossible for PU material to use in the finished goods.

Moreover, when the surface of polyurethane printed by the sublimation transfer process the patterns on the surface of polyurethane comprising polymer layers are not clear and the adhesion of ink to the surface decreases. After transfer the pattern would come to fade out according to the evaporation of the sublimable dye lowers the quality of the product.

**Summary of the Invention**

To surmount the above-mentioned problems the present invention provides a process for sublimation transferring patterns or color fades on a surface of polyurethane products and the polyurethane products printed thereby.

One aspect of the invention is to provide a process that may be used for the sublimation transfer process at an elevated temperature such as more than 180°C by incorporating the silicone material into polyurethane.

Another aspect of the invention is to provide a process that the surface of the polyurethane is able to withstand at the temperature of transfer.

Further aspect of the invention is to provide a process that enables the transfer paper to be easily removed from the surface of polyurethane by preventing the transfer paper and the surface of the polyurethane from adhering each other.

Further aspect of the invention is to provide shoe uppers with printed color fades or various patterns by the sublimation transfer process.
Detailed Description of the Preferred Embodiment

The first embodiment of this invention is a process for sublimation transferring of a pattern on the surface of polyurethane products, characterized by the following steps:

- mixing polyurethane with solvents and silicone to make the mixture a liquid and then drying it to form a polyurethane product;
- placing transfer paper on the surface of product, forming a printing layer at a temperature of 180°C to 220°C under a pressure of 4 to 8 kg/cm²;
- coating the polyurethane film on the surface of print layer.

This invention’s process for sublimation transfer is applied specifically to printing color fades or various patterns on the surface of shoe uppers made of the polyurethane, but it can obviously be applied to any products made of the polyurethane. Also, the term ‘the surface of the polyurethane’ used herein means the surface of a product made of the polyurethane, while in the examples, it means the surface of shoe uppers made of polyurethane.

The principles of the process for sublimation transferring patterns on the surface of polyurethane are as follows. When the wet-dry or dry PU surface is subjected to the conventional sublimation transfer process the PU surface adhered to the transfer paper due to the elevated temperature. Thus, the PU surface could not be separated from the transfer paper. Actually it was impossible to carry out the sublimation transfer process on the surface of polyurethane. To solve these problems one-component polyurethane is mixed with solvents to make the mixture a liquid, added to silicone, and then dried to produce the polyurethane products. As shown in Figure 5a, the PU surface can be easily separated from the transfer paper without adhering each other.

Brief Description of the Drawings

The invention may be more completely understood with consideration of the
following detailed description of various embodiments of the invention along with the accompanying drawings.

Figures 1a to 1c sequentially illustrate, in cross-sectional view, the method of sublimation transferring color fades or various patterns on the surface of shoe uppers made of polyurethane according to the preferred embodiment of the present invention.

Figure 2 shows a photo of shoe uppers formed with color fades print layer by the sublimation transfer process of Figure 1.

Figure 3 illustrates, in cross-sectional view, the surface of shoe uppers of Figure 2 formed polyurethane coating layer thereon.

Figure 4 illustrates, in cross-sectional view, the surface of shoe uppers of Figure 2 adhered polyurethane film thereon.

Figures 5a and 5b are photos of the transferred surface of polyurethanes by the sublimation transfer process.

12: polyurethane coating layer
18: transfer paper
20: print layer
24: polyurethane coating layer
26: polyurethane film
100: the shoe uppers

The invention is described by the following preferred examples. These examples are presented for illustration only and are not intended to limit the invention. In the following examples, the term "parts" means parts by weight, unless otherwise specified.
Examples

Example 1

100 parts of polyurethane, 20 parts of MEK, 20 parts of DMF, 2 to 5 parts, preferably 3 parts of silicone were mixed to make the mixture a liquid.

As shown in Figure 1a, the liquid mixture was applied on the releasing paper (10) to form polyurethane layer (12). Then an adhesive such as bond was applied on the layer to form a adhesive layer (14) which was then adhered to a roll-stock (16). The above-mentioned process preferably describes the process for forming the layers of the releasing paper (10), the polyurethane layer (12), the adhering layer (14), and the roll-stock (16) in order. This process is the same as a process of producing shoe uppers with polyurethane.

Next, as illustrated in Figure 1b, after removing the release paper, the transfer paper (18) printed with color fades or various patterns (18a) was disposed on the surface of the above-mentioned polyurethane layer (12). The conventional sublimation transfer process then transferred this. The transfer condition, preferably at the temperature of 180°C to 220°C under a pressure of about 4 to 8 kg/cm² for a period of about 13 to 25 seconds, depends on the type of shoe uppers.

Then, as can be seen in Figure 1c, the transfer paper (18) was removed to form a printing layer (20) on the surface of the polyurethane layer (12). Therefore the printing layer (20) with color fades was formed on the surface of the shoe uppers (100) as in Figure 2.

Example 2

To improve the vividness of the transferred printing layer (20) on the surface of the shoe uppers shown in Figure 2 and to prevent the sublimation of the transfer ink, the adhesive was applied on the surface of the polyurethane layer (12) printed with color fades as shown in Figure 3 to form a adhering layer (22), and then polyurethane was applied to form polyurethane coating layer (24).
Example 3

Polyurethane film (26) was coated on the surface of polyurethane layer (12) formed the printing layer (20) thereon. The coating process is the conventional thermal compress process.

As described in the above, this process for transferring the pattern on the surface of polyurethane and the resulting polyurethane products have a lot of advantages as follows:

First, the present invention can prevent the polyurethane layer and the transfer paper from adhering each other by incorporating the silicone into the polyurethane and mixing them. Also, the silicone promotes the release between polyurethane and transfer paper by blocking the thermal resistance.

Second, the present invention has effects not only that stains can be easily removed from the polyurethane product but also that polyurethane products can be protected from the scratching.

Third, the prior art method is incapable of transferring a pattern on polyurethane products. In contrast, the present invention has enables sublimation transferability on the surface of the polyurethane. Thus, any polyurethane products such as bags, sheets, sofas, shoes, polyurethane jackets, gloves, wallets, etc can be printed by means of the sublimation transfer process.

The present invention should not be considered limited to the particular examples described above. It should be understood to hold true to all aspects of the invention as fairly set out in the attached claims. Upon review of instant specifications various modifications, equivalent processes, as well as numerous structures to which the present invention may be applicable will be readily apparent to those skilled in the art for whom the present invention is intended.
WHAT IS CLAIMED:

1. A process for sublimation transferring patterns on a surface of polyurethane products comprising of the steps:
   mixing polyurethane with solvents and silicone to make the mixture a liquid and then drying it to make a polyurethane; and
   placing a transfer paper on the surface of product, forming a printing layer with a sublimation transfer process.

2. In the process according to Claim 1 the liquid is made by mixing 100 parts of polyurethane with 15 to 25 parts of MEK, 15 to 25 parts of DMF and 2 to 5 parts of silicone.

3. In the process according to Claim 1, the sublimation transfer process is carried out at a temperature of 180 to 220°C under a pressure of 4 to 8 kg/cm².

4. The process according to Claim 1 to 3 further comprises of the step of coating the polyurethane film on the surface of the printing layer.

5. The process according to Claim 1 to 3 further comprises of the step of coating the polyurethane resin applied adhesive on the surface of the printing layer.

6. Polyurethane products sublimation transferred by the process claimed in any one of Claims 1 to 5.

7. Shoe uppers sublimation transferred by the process claimed in any one of Claim 1 to 5.
Fig 1c
A. CLASSIFICATION OF SUBJECT MATTER
IPC7 B41M 5/38
According to International Patent Classification (IPC) or to both national classification and IPC.

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
IPC7 B41M; B41C;

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Patents and applications for inventions since 1975
Korean Utility models and applications for Utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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☐ Further documents are listed in the continuation of Box C.  ☑ See patent family annex.

"A" Special categories of cited documents:
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"&" document member of the same patent family

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Name and mailing address of the ISA/KR
Korean Intellectual Property Office
920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea
Facsimile No. 82-42-472-7140

Authorized officer
LEE, Hoon Goo
Telephone No. 82-42-481-5587

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