(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
12 September 2014 (12.09.2014)

WIPO | PCT

(10) International Publication Number
WO 2014/135958 A4

(51) International Patent Classification:
H05K 1/03 (2006.01) *H05K 3/12* (2006.01)

(21) International Application Number:
PCT/IB2014/000261

(22) International Filing Date:
4 March 2014 (04.03.2014)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
MI2013A000350 7 March 2013 (07.03.2013) IT
MI2013A001362 7 August 2013 (07.08.2013) IT

(71) Applicant: **D.R.E.T. TECHNOLOGY SAGL** [CH/CH]; c/o SVA Swiss Valor Advisory SA, Corso San Gottardo 8a, 6830 Chiasso (CH).

(72) Inventor: **ZANESI, Davide**; Corso Matteotti 81, 23900 Leccoo (LC) (IT).

(74) Agent: **RICCARDI, Sergio**; c/o IPSER S.r.l., Via Macedonio Melloni, 32, 20129 Milano (IT).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *of inventorship (Rule 4.17(iv))*

Published:

— *with international search report (Art. 21(3))*

— *with amended claims and statement (Art. 19(1))*

Date of publication of the amended claims and statement: 27 November 2014

(54) Title: METHOD OF PRINTING ELECTRONIC SYSTEMS ON TEXTILE SUBSTRATES

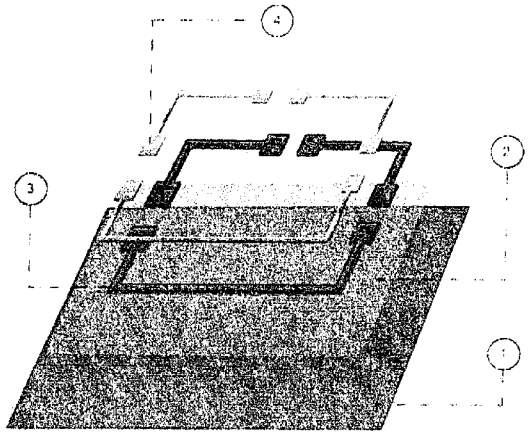

FIG 1

(57) Abstract: The present invention relates to the very innovative field of smart textiles. More particularly the present invention discloses an innovative process for screen printing of textile substrates, by means of primers, for depositing on said substrates dielectric, conductive, resistive, magnetic, electroluminescent materials and many others.

WO 2014/135958 A4

AMENDED CLAIMS
received by the International Bureau on 3 September 2014 (03.09.2014)

1. A method of printing electronic systems on textile substrates (1) by screen printing, comprising the use of primers, insulating materials such as dielectrics (3), conductive materials (4), resistive materials, magnetic materials, electroluminescent materials, thermoelectrical materials and electronic components, and comprising the following steps:

a) sizing the textile substrate (1) or unwinding a textile roll;

b) spraying the primer (2) on the textile substrate, to level the gaps between warp and weft of the textile substrate (1);

c) heat setting the primer (2) by passage through a hot oven or a hot press;

d) printing the insulating layer of dielectric material (3) having thickness range from 10 to 25 μm.

e) drying the insulating layer in the oven;

f) depositing the conductive layer (4) with a dry thickness of 8 to 12 μm, getting a frame having a finer mesh;

g) curing in oven of variable duration depending on the material, variable between 15 - 30 minutes at temperatures varying between 150 ° - 200 ° C; and

h) printing an insulating layer, again by screen printing, or thermopressing by heat press to isolate the traces.

2. The method of claim 1, wherein after the polymerisation stage, in case of application of traditional hard or electronic components or smd, flexible polymeric components and textile components, these are welded by means of conductive pastes or films to the textile substrates.

3. The method according to claim 1, further comprising, in each phase, operations of centering and feeding proper of screen printing.

4. The method according to claim 3, wherein ink-jet technology is also used as an integration or support for deposition.

5. The method according to the preceding claims, wherein the conductive layer (4) is deposited directly on the textile support without intermediate layers printed by ink-jet printing.

6. The method according to claim 1, wherein said textile substrate (1) is preferably a tissue, for example polyester or cotton, or cotton-polyester or non-woven tissue.

7. The method according to claim 1, wherein after the application of a first layer of primer (2) a second layer of dielectric (3) is applied, for example plastisol for screen printing, screen printing water-based pastes, or technical dielectrics.

8. The method according to claim 1, wherein after the application of a first layer of primer (2), a conductive layer (4) is applied, which can be a magnetic, resistive, thermal or electro-luminescent one.

9. The method according to claim 8 and 9, wherein said layers of primer (2), dielectric (3) and conductive layer (4), magnetic, resistive, thermal or electro-luminescent, are printed by screen printing.

10. The method according to the preceding claims, wherein said electrically conductive materials, include, for example particles of copper, or silver, or carbon and aluminum nano tubes.

11. The method according to the preceding claims, wherein said electroluminescent materials, thermo-resistive materials, magnetic or resistive materials, are applicable in form of screen printing paste.

12. The method according to the preceding claims, wherein rigid components, flexible components, or textiles can be assembled directly into the textile substrate by using conductive welding paste, or welding films.

13. The method according to the preceding claims, wherein a double application of substrates is effected for the closure of pores between weft and warp.

14. Electro-textile interface comprising electronic systems printed on textile substrates produced by the method according to one or more of the preceding claims.

STATEMENT UNDER ARTICLE 19 (1)

Applicant files a new amended claim 1 under Article 19 PCT, to better define the technical features of the here described invention.

It has been noted that new amended claim 1 comprises added subject matter of the description as originally filed, to better clarify how the method is inventive, and here below applicant adds some comments. Please also note that claim 6 has been deleted and the preceding claims from 7 to 12 consequently renumbered, and a new filed claim 13 has been filed. Here below applicant files some comments also referring to those other amendments.

These amendments have been made by having carefully examined the international search report and written opinion. Applicant files this amendment in view of the Examiner's evaluation that the subject matter of the originally filed claims is considered new, but not inventive in view of D1, D2, D3, with Examiners' particular reference to D1.

With reference now to originally filed claim 1, and Examiner's comments, at first applicant clarifies that in point 1)b) the primer (2) is preferably sprayed, although as specified in claim 6 said primer can also be applied with other methods. Please note that the primer is sprayed in defined layouts given by a defined trace, studied and realized for subsequently apply the described electronic components. As described in the originally filed description, the here intended primer is not spreaded on the complete surface of the tissue, as usually intended in the prior art. Therefore applicant agrees that the term spreading is in this case not adapted, and could be misleading, in fact "spreading" in this case was intended only as a way to say that a primer (2) is applied, in particular by "spraying".

Please note that in fact all those terms can effectively describe methods or ways to apply primer or different substrates by screen printing, and can be interpreted differently in case of different specification in the description. This is also the case of the term "primer" that for example in D1 is intended as conductive dielectric, but in the present invention, although not defined as specific kind of primer, it is intended as a non-conductive dielectric material as defined in the annexed originally filed description.

Applicant notices that D1,D2, D3 comprise steps of the method that can be considered similar to the one applied in the present invention, but in particular, none of the cited documents teaches how to realize a method of printing electronic system on textile substrates by applying the usual technology, so as to save costs, but to achieve by particular inventive step a surprising result in terms of low cost, and much improved performances; this with particular reference to clothing tissue or similar, so on very thin thickness, and by having a well result, in term of reducing resistance and solve the problem cited at page 6 line 2, to page. 7 line 4. Please note that either for having reduced resistance, and for having a low cost

and performing production, the present inventive method is focused on smart textile so by having the minimum thickness at all by optimizing costs and performances.

In fact, Applicant agrees with Examiner that some particular relevant characteristics, that are described in the originally filed description, were not inserted in old filed claim 1, so as to better define the inventive solution to the technical problem, Applicant files a new amended claim 1:

1. *A method of printing electronic systems on textile substrates (1) by screen printing, comprising the use of primers, insulating materials such as dielectrics (3), conductive materials (4), resistive materials, magnetic materials, electroluminescent materials, thermoelectrical materials and electronic components, and comprising the following steps:*

a) sizing the textile substrate (1) or unwinding a textile roll;

*b) **spraying the primer (2) on the textile substrate,** to level the gaps between warp and weft of the textile substrate (1);*

c) heat setting the primer (2) by passage through a hot oven or a hot press;

*d) printing the insulating layer of dielectric material (3) **having thickness range from 10 to 25 µm.***

e) drying the insulating layer in the oven;

*f) depositing the conductive layer (4) **with a dry thickness of 8 to 12 µm**, getting a frame having a finer mesh;*

g) curing in oven of variable duration depending on the material, variable between 15 - 30 minutes at temperatures varying between 150 ° - 200 ° C; and

h) printing an insulating layer, again by screen printing, or thermopressing by heat press to isolate the traces.

Applicant hopes and believes the new amended claim 1, will be clear, satisfies all the Examiner's requests and comments, and correctly shows how the method is in fact inventive concerning the applications on clothes or other tissues, where the thickness of the textile substrate is fundamental to achieve the wanted technical result.

With reference to the amendments of claim 1:

- what added in point d) is taken from the originally filed description at page 8 line 12 to 21, with reference to the substantially minimum and maximum thickness described;
- what added in point f) is taken from the originally filed description at page 9 line 1.

Now with reference to D1 , D2, D3, and also to Examiner's comments Applicant respectfully underlines that the method of thermopressing is adapted as known, only for flat surfaces, and this advantageously, in combination with the other steps of the method permits to obtain a final product which solves the cited problems emerging from the prior art, by having a smart textile which has improved performances, and is also low cost, by having reduced thickness of dielectrics and conductive layers, by using already existing

equipment's and using them with the new inventive method here described, and having the opportunity to print directly on the final tissue ready to use.

Please note that D1 describes a process using fabrics or tissues on roll and methods for working with, and uses substrates and techniques by working to thickness of 2 to 500 mm, and this very clearly characterizes a totally different field of application, as the smart textiles define a large category of application purposes and are adapted for multiple sectors, and so every different purpose might need a different approach to solve different technical problems, which is the case of D1, D2, D3.

Finally a new claim 13 has been added, to specify that the method can be repeated, and maintain in any case the wanted thickness to optimize the process and performance of the result.

For new added claim 13 please refer to page 9 lines 35 to 27 of the originally filed description.

Applicant believes and hopes, that the here mentioned features, although described in the annexed description on file, but not recited extensively in the claims, may be useful to better define the features of the present invention mentioned in the text and in the annexed drawings.