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MULTIPLE LAYERED PRINT STRUCTURE AND APPARATUS FOR FABRIC OR CLOTH

Abstract

A multiple layered print structure and apparatus to apply a design or image to fabric or cloth is disclosed. The structure may include one or more print layers printed on a substrate and an adhesive layer deposited on the print layer(s). The one or more print layer(s) and adhesive or resin layer may be deposited on the substrate in a pre-set pattern to form the shape profile for the design or image. The print layer(s) include inks or dyes for printing the print features and/or background color(s) of the image or design. The ink may be combined with a binder material to form the print layer(s). In some embodiments, the process includes the step of printing the multiple layered print structure using a combination of digital printing processes simplify the process for printing a design or image on fabric or cloth.

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATION [0001] The application is a continuation of U.S. patent application Ser. No. 18/916,145, filed on Oct. 15, 2024, which is a continuation of U.S. patent application Ser. No. 17/154,449, filed on Jan. 21, 2021, which claims priority to U.S. Provisional Application No. 62/963,846, filed on Jan. 21, 2020, which is hereby incorporated herein in its entirety.

FIELD OF THE INVENTION

[0002] The present disclosure relates to the field of printing multiple layer print structures such as including an image or design on footwear, equipment, fabric or cloth, for example.

BACKGROUND OF THE INVENTION

[0003] There is a demand for custom printing textiles such as shirts (e.g., tee shirts) having a variety of designs thereon, which have become very popular in recent years. Many shirts are sold with pre-printed designs to suit the tastes of consumers. In addition, many customized tee shirt stores are now in the business of permitting customers to select designs or decals of their choice. Processes have also been proposed which permit customers to create their own designs on transfer sheets for application to tee shirts by use of a conventional hand iron, such as those described in U.S. Pat. No. 4,244,358. Furthermore, U.S. Pat. No. 4,773,953, is directed to a method for utilizing a personal computer, a video camera or the like to create graphics, images, or creative designs that can be put on a fabric. These designs may then be transferred to the fabric by way of an ink jet printer, a laser printer, or the like.

[0004] Other types of heat transfer sheets are known in the art. For example, U.S. Pat. No. 5,798,179 is directed to a printable heat transfer material using a thermoplastic polymer such as a hard acrylic polymer or poly (vinyl acetate) as a barrier layer, and has a separate film-forming binder layer. U.S. Pat. No. 5,271,990 relates to an image-receptive heat transfer paper which includes an image-receptive melt-transfer film layer comprising a thermoplastic polymer overlaying the top surface of a base sheet. U.S. Pat. No. 5,502,902 relates to a printable material comprising a thermoplastic polymer and a film-forming binder. U.S. Pat. No. 5,614,345 relates to a paper for thermal image transfer to flat porous surfaces, which contains an ethylene copolymer or an ethylene copolymer mixture and a dye-receiving layer.

[0005] Other examples of heat transfer materials are disclosed in, for example, U.S. Pat. No. 6,410,200 which relates to a polymeric composition comprising an acrylic dispersion, an elastomeric emulsion, a plasticizer, and a water repellant. U.S. Pat. No. 6,358,660 relates to a barrier layer. The barrier layer of U.S. Pat. No. 6,358,660 provides for “cold peel,” “warm peel” and “hot peel” applications and comprises thermosetting and/or ultraviolet (UV) curable polymers. U.S. application Ser. No. 09/980,589, filed Dec. 4, 2001, relates to a transferable material having a transfer blocking overcoat and to a process using said heat transferable material having a transfer blocking overcoat.

[0006] Some of the above-mentioned applications contain specific systems for forming clear images which are subsequently transferred onto the receptor element. However, other heat transfer

systems exist, for example, those disclosed by U.S. Pat. Nos. 4,021,591, 4,555,436, 4,657,557, 4,914,079, 4,927,709, 4,935,300, 5,322,833, 5,413,841, 5,679,461, 5,741,387, and 6,432,514.
[0007] The cited prior art reference (U.S. Pat. No. 5,465,760A) relates to a multi-axial, three-dimensional fabric formed from five yarn systems. The yarn systems included wrap yarn arranged in parallel with the longitudinal direction of the fabric and a first pair of bias yarn layer positioned on the front surface of the wrap yarn and a second pair of bias yarn layer positioned on the back surface of the warp yarn and relates to three-dimensional woven fabric formed of warp, weft and vertical yarns, and more particularly to a three-dimensional woven fabric incorporating a pair of bias yarn layers on the front surface and a pair of bias yarn layers on the back surface of the woven fabric for enhanced in-plane shear strength and modulus vis-a-vis conventional three-dimensional fabric, and also to a method for producing the fabric. Vertical yarn is arranged in a thickness wise direction of the fabric in a perpendicularly intersecting relationship to the warp yarns. Weft yarns are arranged in the widthwise direction of the fabric and in a perpendicularly intersecting relationship to the warp yarns so as to provide a multi-axial, three-dimensional fabric with enhanced resistance to in-plane shear.
[0008] The cited prior art reference (WO2004000049A1) relates to a multi-layered fabric that is particularly suitable for making sports garments. The fabric is characterized in that it includes: a first layer including cellulosic fibers that can be used to form the inside face of a garment; a second layer made entirely from non-cellulosic fibers, the second layer being positioned relative to the first layer such that liquid is able to be transferred from the first layer to the second layer, wherein the fibers of the second layer have a surface energy greater than the surface energy of the fibers of the first layer. There is provided a multi-layered fabric including: a first layer suitable for forming the inside face of a garment, the first layer having at least 90% cellulosic fibers; and a second layer made entirely from non-cellulosic fibers, the second layer being positioned relative to the first layer such that liquid is able to be transferred from the first layer to the second layer; wherein the fibers of the second layer have a surface energy greater than the surface energy of fibers of the first layer. The fibers of the second layer therefore have a greater affinity for liquid than the first layer such that the wicking gradient of the fabric increases from the first layer to the second layer and thereby draws sweat away from the person wearing a garment made from the fabric.
[0009] The cited prior art reference (U.S. Pat. No. 8,940,387B2) comprises a disposable carrier film onto which a release layer and PU inks are printed using layering techniques. The ink layers can be multi-colored, and each color is applied sequentially using a conventional screen-printing method. A back-up layer, a lacquer layer, and an adhesive layer are printed in sequence over the ink layers. The ink includes reflective particles providing the optical effect of a 3-dimensional appliqué. The artwork is created by overlapping design layers to controlled specification sequences. This is achieved by way of ink layering techniques and/or incorporation of additives such as reflective particles in an ink and/or non-planar configuration of a substrate and/or incorporation of a textile insert to provide physically different depths, and/or deposition of ink and flock of different or similar depths alongside each other in a pattern. The ink, because of the additives, creates a desired color tone, and this may be enhanced by layering the ink in an overlapping region. Thus, there are three main regions, namely a central region with reflective ink, a “shoulder” region with overlapping matt and reflective inks and an outer region with only matt ink.
[0010] The cited prior art reference (U.S. Pat. No. 8,993,061B2) relates to a three-dimensional printing directly onto an article of apparel. Disclosed is a method and system for direct three-dimensional printing onto an article of apparel, including designing a three-dimensional pattern for printing onto the article, positioning at least a portion of the article on a tray in a three-dimensional printing system, the portion being positioned substantially flat on the tray, printing a three-dimensional material directly onto the article using the designed pattern, curing the printed material, and removing the article from the three-dimensional printing system. The methods and systems for 3D printing and assembly of an article of footwear include having an upper that

includes 3D printing directly onto the upper material. In particular, an exemplary method is disclosed for 3D printing directly onto a fabric material, which allows building of a structure on the fabric for use in apparel applications. The disclosed methods and systems may use any suitable 3D printing system.

[0011] The cited prior art reference (WO2009032868A1) relates to nonwoven fabric composites comprising layers of spun bond and melt blown nonwoven webs. Such composites are prepared by forming or assembling the layers of the composite such that there is at least one outer layer of spun bond fibers disposed on at least one inner melt blown layer. The at least one outer layer comprises substantially parallel stripes of spun bond, continuous filament fibers with at least two different types of stripes being used. The stripes of fibers within the spun bond layer(s) are also predominately oriented in the machine direction of the nonwoven fabric composite. such nonwoven fabric composites comprise: a) at least one inner layer comprising melt blown fibers; and b) at least one outer layer disposed on one side of the at least one inner layer. The outer layer(s) is/are fashioned from spun bond, continuous filament fibers comprising different fibers formed from at least two different types of polymeric material. All layers of the fabric composites herein are bonded together via thermal, adhesive, ultra-sonic or mechanical bonding means. Such composites can be fashioned to vary the ratio of cross direction stretch to machine direction stretch.

[0012] The cited prior art reference (U.S. Pat. No. 9,005,710B2) relates to methods and systems for apparel assembly using three-dimensional printing directly onto fabric apparel materials. Disclosed is a method and system for direct three-dimensional printing and assembly of an article of apparel, including designing a three-dimensional pattern for printing, positioning at least a portion of the article on a tray in a three-dimensional printing system, the portion being positioned substantially flat on the tray, printing a three-dimensional material directly onto the article using the designed pattern, curing the printed material, and removing the article from the three-dimensional printing system. The methods and systems for 3D printing and assembly of an article of footwear having an upper that includes 3D printing directly onto at least a first portion of an upper material and a sole formed by 3D printing onto at least a second portion of the upper material. In particular, an exemplary method is disclosed for 3D printing directly onto a fabric material, which allows building of a structure on the fabric for use in apparel applications. The disclosed methods and systems may use any suitable 3D printing system.

[0013] A hybrid process involving screen printing in conjunction with direct to garment printing has been disclosed in U.S. Pat. No. 10,131,160. As stated in the document, the direct to garment (DTG) process utilizing the inkjet print-heads could be slow and thus be economically disadvantageous for longer runs. Therefore, in order to overcome the limitations of DTG, a process has been disclosed where white or underbase layers are printed by a screen-printing process followed by printing an image using a DTG printer. The disclosed process would still require additional steps for creating the silk-screen for each custom print job, which would result in additional expense and time. U.S. Pat. No. 10,532,585 also refers to the image quality and production speed challenges with direct-to-garment applications.

Problems with many known transfer sheets include the expense involved in coating layer upon layer of different solutions onto a support material. The repetition of the multi-step process increases the print time. Thus, there is a need in the art for an effective, and efficient method for printing.

BRIEF SUMMARY OF THE INVENTION

[0014] The present disclosure, in one embodiment, includes the steps of selecting a design or image in step and printing a multiple layered print structure for the image or design in step to apply the design or image to fabric or cloth. The illustrated process including the step of printing the multiple layered print structure simplifies the process for printing a design or image on fabric or cloth.

[0015] In the embodiment, the structure includes one or more print layers printed on substrate and an adhesive layer deposited on the print layer(s). The one or more print layer(s) and adhesive or

resin layer are deposited on the substrate in a pre-set pattern to form the shape profile for the design or image. Print layer(s) includes inks or dyes or toners for printing the print features and/or background color(s) of the image or design. In the illustrated embodiment, the ink is combined with a binder material to form the print layer(s). Illustrative binder materials include, but are not limited to, polyurethane, or polymer particles such as polyolefin, polyamide, and polyester particles, and/or co-polymer blends. The inks or dyes can be mixed with the binder material or the materials can be deposited as separate layers.

[0016] The multiple layered print structure as described is created by a printing apparatus using a digital print pattern to deposit multiple layers of the multiple layered structure in the pre-set pattern to form the shape profile and print features. In the embodiment printing apparatus includes a plurality of print heads to deposit the layers of the multiple layered structure on substrate. As shown, the substrate is movable along a feed path in the x-direction as illustrated by arrow via an x-axis drive assembly. As shown, the heads are spaced along the feed path to sequentially deposit the layers of the multiple layered structure on the substrate as the substrate moves past the heads via operation of the x-axis drive assembly. Heads move crosswise relative to the feed path of the substrate as illustrated by arrow to deposit material across a width of the substrate via operation of a y-drive assembly.

[0017] In alternate embodiments of the printing apparatus for printing the multiple layered printing structure, the printing apparatus includes one or more rotating photosensitive drums for depositing one or more layers of the multiple layered structure. In the embodiment, the printing apparatus includes multiple drums for depositing the adhesive, receptive layer, opaque layer, printing ink layer and/or any additional optional release layer or other layer(s) based upon the digital print pattern. A charged pattern or differentially charged image is applied to the drums through a laser device or other operating mechanism to collect charged powder or ink and transfer the powder or ink image to the substrate. In alternate embodiments, the printing apparatus uses liquid electrophotography printing processes and machines such as machines available from HP Indigo of HP Inc of Palo Alto California. In the embodiment shown, a separate drum is used to apply charged adhesive powder, receptive, opaque and printing ink powders or other materials, however in alternate embodiments one or more of the multiple layers or powders are combined and deposited on a single drum.

[0018] In embodiments, the multiple layers of the multiple layered print structure are deposited on a substrate having a base layer and a release layer or coating to transfer the multiple layered print structure to a fabric or cloth item. Illustrative base layers are formed of a material capable of withstanding high temperatures and which can handle multiple print layers and coatings as described. Suitable base layers include a paper web, plastic film, wood pulp fiber paper, metal foil, parchment paper, lithographic printing paper, clear film or similar materials. The release layer or coating is applied to the base layer of the substrate to facilitate separation of the multiple layered print structure from the substrate for image transfer. Illustratively the release layer or coating is a silicone coating or wax-based or other material that releasably adheres the multiple layered print structure to the base layer of the substrate for application to fabric or cloth item.

[0019] While multiple embodiments are disclosed, still other embodiments of the present disclosure will become apparent to those skilled in the art from the following detailed description, which shows and describes illustrative embodiments of the disclosure. As will be realized, the various embodiments of the present disclosure are capable of modifications in various obvious aspects, all without departing from the spirit and scope of the present disclosure. Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not restrictive.

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aspects, all without departing from the spirit and scope of the present disclosure. Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not restrictive.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter that is regarded as forming the various embodiments of the present disclosure, it is believed that the disclosure will be better understood from the following description taken in conjunction with the accompanying Figures, in which:

[0022] FIG. **1**A illustrates process steps for printing an image or design on fabric or cloth of the prior art.

[0023] FIG. **1**B illustrates steps of an illustrative embodiment of the present application for applying an image or design to fabric or cloth.

[0024] FIG. **2**A illustrates an embodiment of a multiple layered print structure having a shape profile and print feature for an image or design.

[0025] FIG. **2**B illustrates an embodiment of a multiple layered print structure having a shape profile and plurality of print features.

[0026] FIGS. **3**A-**3**P illustrate embodiments of the multiple layered print structures of the present application.

[0027] FIG. **4**A is a schematic illustration of a top view of a printing apparatus for printing multiple layers of the multiple layered print structure of the present application.

[0028] FIG. **4**B is a schematic illustration of another embodiment of a printing apparatus including a plurality of printing heads.

[0029] FIG. **4**C illustrates a carriage assembly including a movable carriage for a plurality of print heads of the printing apparatus.

[0030] FIG. **4**D illustrates a printing apparatus including a plurality of movable carriages for a plurality of print heads of the printing apparatus.

[0031] FIG. **4**E is a top view of an embodiment of a carriage assembly operable via an x-y drive mechanism to deposit layers of the multiple layered print structure.

[0032] FIG. **4**F is a side view of the embodiment illustrated in FIG. **4**E.

[0033] FIG. **4**G schematically illustrates an embodiment of a printing apparatus including a substrate platform movable via x-y drive mechanisms to deposit multiple print layers.

[0034] FIG. **4**H schematically illustrates heads for an embodiment of the printing apparatus.

[0035] FIG. **4**I illustrates another embodiment of heads for a printing apparatus of the present application.

[0036] FIG. **4**J schematically illustrates another embodiment of printing heads for a printing apparatus of the present application.

[0037] FIG. **5**A illustrates an embodiment of a printing apparatus including printing drums for depositing multiple print layers of the multiple layered print structure.

[0038] FIG. **5**B is a side view of a printing apparatus including a plurality of drums.

[0039] FIG. **5**C illustrates a printing process using multiple printing apparatus at multiple printing stations to deposit the multiple layered print structure.

[0040] FIG. **6**A illustrates an application for converting an image or design into a digital print pattern for use by a controller to control the plurality of heads or printing apparatus.

[0041] FIG. **6**B is a flow chart illustrating steps for printing the multiple layered print structure for fabric or cloth.

[0042] FIG. **7**A illustrates an embodiment for transferring the multiple layered print structure to a fabric or cloth item via application of heat and pressure.

[0043] FIGS. **7**B-**7**D illustrate other embodiments for transferring the multiple layered structure to a fabric or cloth item FIGS. **2**A-B illustrate a, in accordance with one embodiment.

DETAILED DESCRIPTION

[0044] The present invention includes in some embodiments a multilayer print structure that may include one or more layer(s) printed utilizing a combination of digital printing processes. The combination of multiple digital printing technologies such as laser, inkjet, liquid electrophotography, for example offer the advantage of printing layer(s) at a faster pace than prior art printing techniques. Upon combining one or more of these above-stated processes along-with inkjet printing, multilayer layered print structures can be created digitally while eliminating the steps needed for conventional printing such as silk-screen. The structure includes in some embodiments one or more print layers printed on a substrate and an adhesive layer deposited on the print layer(s). The one or more print layer(s) and adhesive or resin layer may be deposited on the substrate in a pre-set pattern to form the shape profile for the design or image. Print layer(s) may include inks or dyes for printing the print features and/or background color(s) of the image or design. The ink may be combined with a binder material to form the print layer(s) in some embodiments. Illustrative binder materials include, but are not limited to, a polyurethane binder or polymer particles such as polyolefin, polyamide, and polyester particles, and/or co-polymer blends. In some embodiments, the present application includes the steps of selecting a design or image for printing and printing a multiple layered print structure for the image or design on a transfer substrate and thereby transferring it onto fabric or cloth. The illustrated process may include the step of printing the multiple layered print structure utilizing a combination of digital printing processes to simplify the process for printing a design or image on fabric or cloth, in some embodiments.

[0045] There is a demand for custom printed t-shirts and novelty items. Screen printing techniques used by custom printers include multiple steps which can be time and labor intensive. For example, as shown in FIG. **1**A, custom printing typically involves selecting a design or image as illustrated by step **100**. A mask is cut for the selected design or image as illustrated in cutting step **104** and the mask is weeded as shown in weeding step **106**. As shown in step **108**, the mask is applied to a print screen or other device and the mask is used to print the image or design on fabric or cloth as shown in step **110**. For complex designs and color schemes, the process involves multiple masking, screen preparation and printing steps. Methods such as application and exposure of photosensitive emulsions could also be employed for silk-screen preparation. In contrast, in some embodiments of the present application as shown in FIG. **1**B, the process may include the steps of selecting a design or image as shown in step **112** and printing a multiple layered print structure for the image or design as shown in step **114** to apply the design or image to fabric or cloth, for example. The illustrated process including the step of printing the multiple layered print structure simplifies the process for printing a design or image on fabric or cloth.

[0046] FIG. **2**A illustrates an embodiment of a multiple layered print structure **120** for a selected design or image of the present application. As shown, the multiple layered print structure **120** is formed on substrate **122** and includes a shape profile **124** corresponding to a shape of the desired image or design and one or more print features **126**. In the embodiment shown in FIG. **2**A, the shape profile **124** is a “1” shape and the print feature **126** provides a background color or pattern. In an alternate embodiment, the multiple layered print structure **120** has a round shape profile **124** and a plurality of print features **126** including a quilted pattern of a soccer ball and the name “SAM”. While FIGS. **2**A-**2**B illustrate example shape profiles **124** and print feature **126** applications, the present application is not limited to any particular shape or number or type of print features or profiles for the multiple layered print structure **120**.

[0047] FIGS. **3**A-**3**P illustrate embodiments of the multiple layered print structures **120** of the present application. In the embodiment shown in FIG. **3**A, the structure **120** includes one or more print layers **140** (only one illustrated in FIG. **3**A) printed on substrate **122** and an adhesive layer

142 deposited on the print layer(s) **140**. The one or more print layer(s) **140** and adhesive or resin layer **142** are deposited on the substrate **122** in a pre-set pattern to form the shape profile **124** for the design or image. Print layer(s) **140** includes inks or dyes for printing the print features and/or background color(s) **126** of the image or design. In the illustrated embodiment, the ink is combined with a binder material to form the print layer(s) **140**. Illustrative binder materials include, but are not limited to, a polyurethane binder or polymer particles such as polyolefin, polyamide, and polyester particles, and/or co-polymer blends. The inks or dyes can be mixed with the binder material or the materials can be deposited as separate layers (not shown).

[0048] As shown in FIG. **3**A, the adhesive layer **142** is deposited on the print layer(s) **140** to correspond to the shape profile **124** of the image or design. Illustrative adhesives include, but are not limited to, thermoplastic polymers such as polyamide, polyolefin, polyester and other copolymer and mixtures thereof that are adherable to cloth or fabric, for example. Other adhesives include, but are not limited to, ethylene copolymer, ethylene acrylic acid, ethylene meth-acrylic acid and/or ethylene-vinyl acetate. Adhesives may also include one or more of pressure-sensitive adhesives (PSA), ultra-violet (UV) cured adhesives, electro-beam (EB) cured adhesives, water-activated adhesives, spray adhesives and/or powder adhesives, for example. The PSA may include one or more of permanent and removable adhesive compositions. The adhesive layer could also comprise multiple layers deposited using one or more adhesive combinations while utilizing one or more printing processes. In an illustrative embodiment, an additional adhesive receptive layer may be deposited prior to depositing the powder adhesive. The powder adhesive may also be deposited or sprinkled or sprayed inline or offline while the previously deposited layer is still in a wet or tacky state. The powder adhesive adheres to this wet/tacky layer to create a shape profile, while the additional powder is removed from the non-image areas by shaking/agitation, vacuum, blowing, other mechanical processes, for example. Powder adhesive could also be applied while utilizing a mechanical powder adhesive coater/applicator, for example. Upon application of the adhesive, the layers may be cured using an inline or offline curing assembly. Illustrative adhesive receptive layers include, but are not limited to one or more polymers, copolymers or mixtures thereof. Examples of such polymers include, but are not limited to, acrylic polymer, acrylate polymer, polyester, polyvinyl alcohol, poly vinyl pyrollidone, poly vinyl chloride, poly vinyl acetate, polyurethane, vinyl acetate, styrene-butadiene polymer, styrene-acrylate, ethylene copolymer, ethylene acrylic acid, ethylene methacrylic acid, and/or ethylene-vinyl acetate.

[0049] In an alternate embodiment shown in FIG. **3**B, the adhesive layer **142** is deposited on substrate **122** and the print layer(s) **140** is deposited on the adhesive layer **142**. As previously described, both layers may be deposited in the pre-set pattern to form the shape profile **124** and the print layer(s) **140** form the print features **126** as described. FIG. **3**C illustrates another embodiment of layers of the print structure **120** for use with dark fabric or cloth including an opaque layer(s) **144** printed on the substrate **122**. The opaque layer **144** is used to obscure a dark pigment or dark colored fabric so that the print layer(s) **140** is visible. The opaque layer **144** comprises an opaque or white pigment in a binder material(s) such as polyurethanes, polyesters, styrene-butadiene polymers, acrylate polymers, styrene-acrylate polymers, acrylic polymers, ethylene-vinyl acetate copolymers, ethylene methacrylate acid copolymers, and/or ethylene-acrylic acid copolymers. Examples of suitable white pigments include silica, alumina, titanium dioxide, zinc sulfide, zinc oxide, antimony oxide, barium sulfate, calcium carbonate and the like or other materials that obscure dark pigments. The opaque layer as well as other printing layers may also include other additives such as wetting agents, defoamers, anti-foaming agents, humectants, rheology modifiers, surfactants, and/or dispersants, for example. The opaque layer could be deposited in one or more layers through one or more printing processes.

[0050] In the embodiment shown in FIG. **3**C, the print layer(s) **140** is deposited on the opaque layer **144** and the adhesive layer **142** is deposited on the print layer(s) **140**. In another embodiment shown in FIG. **3**D, adhesive layer **142** is deposited on the substrate **122** and opaque layer **144** is

deposited on adhesive layer **142**. Print layer(s) **140** as shown is deposited on opaque layer **144** to form the multiple layered print structure **120**. In the embodiment illustrated in FIG. **3**E, the print layer(s) **140** is deposited on the substrate **122**, and the opaque layer **144** is deposited on the print layer(s) **140**. The adhesive layer **142** is deposited over the opaque layer **144** as shown. In the embodiment shown in FIG. **3**F, the adhesive layer **142** is deposited on the substrate **122** and the print layer(s) **140** is deposited on the adhesive layer **142** and the opaque layer **144** is deposited on the print layer(s) **140**.

[0051] FIGS. **3**G-**3**H illustrate embodiments of a multiple layered print structure **120** including adhesive layer **142** and print layer(s) **140** deposited on the substrate **122** and FIGS. **3**I-**3**L illustrate a multiple layered print structure **120** including adhesive layer **142**, opaque layer **144** and print layer(s) **140** deposited on substrate **122** as shown. In each of the embodiments shown in FIGS. **3**G-**3**I, the multiple layered structure includes a receptive layer **145** for depositing the print layer(s) **140** in FIGS. **3**G-**3**H and print and opaque layers **140**, **144** in FIG. **3**I-**3**L. Illustrative print receptive layers **145** include one or more of acrylic polymer, polyvinyl alcohol, poly vinyl pyrrolidone, poly vinyl acetate, polyurethane, styrene-butadiene polymer, styrene-acrylate polymer, vinyl acetate, ethylene copolymer, acid groups, ethylene acrylic acid, ethylene methacrylic acid or ethylene-vinyl acetate, for example. In illustrative embodiments, the print receptive layer(s) **145** also includes pigments such as, but not limited to silica, alumina, calcium carbonate, wax-modified pigments, and the like.

[0052] In the embodiments shown in FIGS. **3**G, **3**I and **3**K, the receptive layer **145** is deposited on the substrate **122** and the opaque and print layer(s) **140**, **144** are deposited on the receptive layer **145** in FIGS. **3**I-**3**K and the print layer(s) **140** are deposited on the receptive layer **145** in FIG. **3**G. In the embodiments shown in FIGS. **3**H, **3**J and **3**L, the receptive layer(s) **145** is deposited on the adhesive layer **145** and the opaque and print layer(s) **140**, **144** are deposited on the receptive layer in FIGS. **3**J and **3**L and the print layer(s) **140** are deposited on the receptive layer **145** in FIG. **3**H. As shown in each of the illustrated embodiments of FIGS. **3**G-**3**L, the adhesive **142**, print layer(s) **140** and receptive layer **145** are deposited in the pre-set pattern to form the shape profile **124** and the one or more print features **126**. In alternate embodiments shown in FIGS. **3**M-**3**N, the adhesive layer **142** is deposited on the substrate **122** and the print layer(s) **140** and opaque layer **144** is formed on the adhesive layer in the pre-set pattern or shape profile **124**. In the embodiments illustrated in FIGS. **30** and **3**P, the adhesive layer **142** and receptive layer **145** are deposited on the substrate **122** and the print and opaque layers **140**, **144** are deposited on the receptive layer **144** in the preset pattern or profile **124**.

[0053] The multiple layered print structure **120** as described may be created by a printing apparatus **150** using a digital print pattern **152** to deposit multiple layers of the multiple layered structure **120** in the pre-set pattern to form the shape profile **124** and print features **126**. FIGS. **4**A-**4**B illustrate an embodiment of printing apparatus **150** including a plurality of print heads **154** to deposit the layers of the multiple layered structure **120** on substrate **122**. As shown, the substrate **122** is movable along a feed path in the x-direction as illustrated by arrow **156** via an x-axis drive assembly **158** (illustrated schematically). As shown, the heads **154** are spaced along the feed path to sequentially deposit the layers of the multiple layered structure **120** on the substrate **122** as the substrate **122** moves past the heads **154** via operation of the x-axis drive assembly **158**. Heads **154** move crosswise relative to the feed path of the substrate **122** as illustrated by arrow **160** to deposit material across a width of the substrate **122** via operation of a y-drive assembly **162**.

[0054] Operation of the x-drive and y-drive assemblies **158**, **162** is controlled via controller **164**. The controller **164** includes various hardware and software components to generate control signals to operate the drive assemblies **158**, **162** to position the heads **154** to form the multiple layered print structure **120** for the image or design.

[0055] As shown in FIG. **4**B, the printing apparatus includes substrate platform **165** movable via x-drive assembly **158** and a plurality of heads **154** movable relative to the substrate platform **165** via

y drive assembly **162** as schematically shown. The printing apparatus **150** also includes a z-drive assembly **166** to adjust spacing between the print head(s) **154** and the substrate platform **165** to provide close spacing between the heads **154** and substrate **122** for printing and compensate for spacing changes between the substrate **122** and the heads **154** as layers are added to the substrate **122**. The z-drive assembly is coupled to one or both of the head(s) **154** or substrate platform **165** to adjust spacing for printing the multiple layered print structure **120**. Thus, as described in FIGS. **4**A-**4**B, substrate **122** is moved along the x-axis as illustrated by arrow **156** and heads **154** move crosswise along y axis as illustrated by arrow **160** to provide an x-y bi-directional print pattern for fabricating the multiple layered print structure **120**.

[0056] Heads **154** move crosswise as illustrated by arrow **160** via operation of y-drive assembly **162** as previously described. In an illustrated embodiment, heads **154** are coupled to a carriage assembly which includes one or more carriages **180** moveable along a track or rail **182** via operation of a linear drive actuator or mechanism **184** under control of controller **164**. Illustrative drive mechanisms **184** include drive belts, drive motors and other electrical or electro-magnetic drive device to move the carriage **180** along track or rail **182**. In the embodiment shown in FIG. **4**C, the carriage **180** includes multiple heads **154**. In an alternate embodiment shown in FIG. **4**D, the assembly includes multiple carriages to provide a separate carriage **180** for each of the heads **154**. As shown heads **154** are coupled to separate carriages **180** for crosswise movement as illustrated by arrow **160**.

[0057] In an alternate embodiment shown in FIG. **4**F, heads **154** are moved in an x-y pattern relative to the substrate **122**. As shown one or more heads **154** are supported on carriage **180** movable along rail or track **182** in the y direction **160** via y drive mechanism **184**. Track or rail **182** is coupled to and movable along x track **188** via operation of x drive mechanism **190** to provide x-y axis movement of the heads **154** relative to the substrate to deposit the multiple layered print structure **120** as described. As schematically shown in FIG. **4**F, the z-drive assembly **166** includes z-drive mechanism **192** coupled to the carriage **180** or substrate platform **165** to adjust an elevation of one or both of the carriage **180** or substrate platform **165** to adjust the spacing between the heads **154** and substrate **122** for printing.

[0058] In the illustrated embodiment of FIG. **4**G, the one or more carriages **180** or carriage assembly are stationary or fixed and the substrate platform **165** moves in the x-y plane via x-y drive mechanisms to deposit the print layers on the substrate **122**. In addition, as schematically shown, the z-drive mechanism is coupled to the substrate platform **165** to move the platform in the z-direction to adjust spacing between the heads and the substrate platform **165** as the print layers are deposited as previously described. Alternatively, the heads move in the x-direction where the substrate may move in the y-direction eliminating z-directional movement. While particular embodiments are shown, the application is not limited to the particular arrangements or embodiments shown and any combination of drive mechanisms, carriages or other structures can be used for printing the multiple layered structure **120**. A combination of various digital printing processes such as laser, indigo, and/or ink-jet, for example. could be used inline or offline to create the multiple layered print structure of the present disclosure. For example, in one embodiment a combination of ink-jet and laser/indigo printing processes may be used. Though it should be understood that any combination is contemplated by the present disclosure.

[0059] FIG. **4**H illustrates heads **154** of an illustrative printing apparatus **150**. In the embodiment shown, the plurality of heads **154** include one or more of an adhesive layer head **154**, a print layer head **154**, and an opaque layer head **154**. Additionally, the plurality of heads includes a receptive layer head for depositing the receptive layer and a curing head to dry and cure liquid ink layers deposited on the substrate **122**. Each of the heads includes a controllable operating mechanism **195** that interfaces with controller **164** through circuitry to dispense or prints material on the substrate based upon the digital print pattern **152**. Although a particular order is shown for the heads, application is not limited to a particular order or arrangement, and order or arrangement will

depend upon the particular multiple layered print structure **120**.

[0060] Illustratively the adhesive head can be a spray head including a valve structure or other operating mechanism to deposit adhesive or other layer(s) in response to input from the controller **164**. The adhesive layer **142** can be a flowable/liquid adhesive or a powered adhesive. In illustrative embodiments, the one or more heads include an extrusion head having a movable pin operable to form the controllable operating mechanism **195** for selectively dispensing material from the head. In other embodiments, the heads include a PZT print head operable to controllably dispense material via a piezoelectric (PZT) transducer element via control signals provided through an electrical interface or cable. Other heads for dispensing layers of the multiple layered print structure include thermal print heads operable via thermal transducer elements or electrostatic print heads operable through electrostatic transducer elements to selectively print the multiple layers of the print structure. In illustrated embodiments, a curing head **154** is provided to dry and cure liquid or water-based inks following deposition from one or more print heads to form the shape profile **124** and print features **126** of the multiple layered print structure **120**. The curing head may utilize one or more of following curing technologies such as thermal curing, UV curing and EB curing technology. It will be appreciated, that the disclosure includes embodiments where the curing process may be completed either inline or offline, and further contemplates alternate curing head arrangements and/or curing assemblies.

[0061] In illustrated embodiments, the printing apparatus **150** includes a plurality of ink heads or cartridges to deposit multiple colored print layers. As shown in FIG. **4**I, the plurality of ink heads or cartridges include black, cyan, magenta and yellow ink cartridges or heads. The black, cyan, magenta and yellow inks are contained in reservoirs of the cartridges or heads **168** and dispensed through operating mechanism **195** in response to input from the controller **164** as previously described. In another embodiment shown in FIG. **4**J, the apparatus includes a composite print head for both the adhesive and obscuring layers **142**, **144**.

[0062] In alternate embodiments of the printing apparatus for printing the multiple layered printing structure, the printing apparatus includes one or more rotating photosensitive drums **198** for depositing one or more layers of the multiple layered structure. In the embodiment shown in FIG. **5**A-**5**B, the printing apparatus includes multiple drums **198** for depositing the adhesive, receptive layer, opaque layer, printing ink layers, and/or any additional optional release layer or other layer(s) based upon the digital print pattern **152**. A charged pattern or differentially charged image is applied to the drums **198** through a laser device or other operating mechanism **195** to collect charged powder or ink and transfer the powder or ink image to the substrate. In alternate embodiments, the printing apparatus uses liquid electrophotography printing processes and machines such as machines available from HP Indigo of HP Inc. of Palo Alto California, for example. In the embodiment shown, a separate drum **198** may be used to apply charged adhesive powder, receptive, opaque, printing ink powders and/or additional optional release layer, or materials, however in alternate embodiments one or more of the multiple layers or powders may be combined and deposited on a single drum **198**. Alternatively, drive arrangements or carriages as offered by various electrophotography or liquid electrophotography printing processes such as laser printers, copiers, digital presses, and/or HP Indigo, for example could be used to create the multilayered print structure.

[0063] In alternate embodiments of the present application, the process of printing the multiple layers uses multiple printing apparatus to print one or more layers of the multiple layered structure at separate printing stations **199**. In an illustrative embodiment, the multiple printing apparatus or stations include an adhesive printing apparatus to deposit the adhesive layer, an opaque printing apparatus to deposit the opaque layer and an ink printing apparatus to deposit the ink layers. It should be understood that the application is not limited to a particular number of stations **199** and the number of stations will depend upon the number of layers deposited to form the multiple layered print structure. Each of the printing stations or processing stations may include x-y-z drive

mechanism(s) coupled to the carriage/head, drum and/or substrate platform **165**, in some embodiments. The x-y-z drive mechanism(s) receives input from the controller **164** to position the head/substrate for printing in response to the digital print pattern **152**.

[0064] As previously described, the controller **164** may use a digital print pattern **152** to create the multiple layered print structure **120** for the image or design. The image or design can be created through a computer **200** having hardware and software components to run an image creator software or application **202** to create an image having a shape profile **124** and print features **126** as shown in FIG. **6**A. A user creates the desired image via interface with the creator software or application **202** using input devices such a mouse, keyboard, or stylus pen (not shown). Once the image is complete, a digital print pattern generator or application **204** compiles or generates the digital print pattern **152**. The digital print pattern generator **204** includes instructions and code to generate the digital print pattern **152** for the multiple layered structure **120**.

[0065] The digital print pattern **152** may be used by the controller **164** to control the printing apparatus including the drive and operating mechanisms of the printing apparatus to print the multiple layered print structure **120**. Thus, as shown in FIG. **6**B, digital print pattern **152** for an image or design may be created using a computer application or software in step **210**. In step **212**, the control signals for the operating mechanisms and drive mechanisms are provided to the printing apparatus(s) and in step **214**, layers of the multiple layered print structure are deposited using the digital print pattern **152**.

[0066] In embodiments shown in FIGS. **7**A-**7**D, the multiple layers of the multiple layered print structure **120** are deposited on a substrate **122** having a base layer **220** and a release layer or coating **222** to transfer the multiple layered print structure **120** to a fabric or cloth item **224**. Illustrative base layers **220** are formed of a material capable of withstanding high temperatures and which can handle multiple print layers and coatings as described. Suitable base layers **220** include, but are not limited to, a paper web, plastic film, wood pulp fiber paper, metal foil, parchment paper, lithographic printing paper, clear film or similar materials. The release layer or coating **222** may be applied to the base layer **220** of the substrate **122** to facilitate separation of the multiple layered print structure **120** from the substrate **122** for image transfer. Illustratively, the release layer or coating may be a silicone coating, or wax-based material, or other material or combination of materials that releasably adheres the multiple layered print structure **120** to the base layer **220** of the substrate for application to fabric or cloth item **224**. The release layer in some embodiments may be a continuous coated layer, or in other embodiments may be spot printed. The release layer could be spot printed/applied by digital printing methods such as laser, liquid electrophotography, and/or inkjet, for example to create the desired shape profile.

[0067] As shown in FIG. **7**A, adhesive, opaque and print layers **142**, **144**, **140** are deposited on a substrate **122** to form the multiple layered print structure **120** as previously described. As shown, the multiple layered structure **120** may be released from the substrate **122** and placed on the fabric item **224**. In an illustrated embodiment, a releasable tacky layer or masking tape **226**, for example may be used to facilitate release of the multiple layered structure from the substrate. Heat and pressure are applied to the multiple layered structure **120** to melt the adhesive layer **142** to adhere the structure to the cloth or fabric item **224**. Heat and pressure may be applied through a protective or non-stick sheet **230** to protect the multiple layered print structure **120** and fabric from the heat source. In embodiments where a pressure-sensitive adhesive (PSA) is used, application of heat is optional when transferring to the receptor.

[0068] In an alternate embodiment shown in FIG. **7**B, the multiple layered print structure **120** includes an adhesive layer **142** printed on the substrate **122**, a reverse print layer **140** printed on the adhesive layer **142** and an opaque layer **144** layer printed on the reverse print layer **140**. The layers are similarly printed on substrate **122** having the release coating or layer **222**. For attachment to the fabric or cloth item **224**, the structure **120** is flipped so that the adhesive layer **142** is on top and the opaque layer **144** abuts a surface of the cloth or fabric item **224**. Heat and pressure are applied to

the multiple layered print structure **120** through protective sheet **230** to adhere the structure to the fabric or cloth item **224**. In an illustrative embodiment, heat and pressure are applied through substrate **122** which forms a protective sheet in an illustrative embodiment. Following attachment to the fabric or cloth item **224**, the substrate **122** is released from the multiple layered structure **120**. As described, the print layer **140** of the multiple layered structure **120** is printed with a reverse or mirror image of the design or image so that after the structure **120** is flipped the image and feature orientation is not mirror image.

[0069] In an alternate embodiment shown in FIG. **7**C, the opaque layer **144** is printed on the substrate, print layer(s) **140** are printed on the opaque layer **144** and the adhesive layer **142** is printed on the print layer(s) **140**. As shown, the layers of the structure are released from the substrate **122** and adhered to the cloth or fabric item **224** via the application of heat and pressure to melt the adhesive layer **142** into the fabric or cloth item **224**. In the illustrated embodiment, a releasable tacky layer or masking tape **226** may be used to facilitate release of the multiple layered structure from the substrate. In the embodiment shown in FIG. **7**D, a reverse image print layer **140** may be deposited on the substrate **122**. Opaque layer **144** is deposited on print layer(s) **140** and the adhesive layer **142** is deposited on the opaque layer as shown. The print structure **120** is flipped as previously described with respect to the embodiment of FIG. **7**B for attachment to the fabric or cloth item **224**. As described, the substrate **122** is used as a protective sheet **230** to apply heat and pressure to attach the multiple layered structure **120** to the fabric or cloth item **224**. Once attached the substrate **122** is removed.

[0070] As described, the multiple layered print structure **120** includes a shape profile **124** and one or more print features **126** to form a particular image or design according to a digital print pattern **152**. Various materials can be used for the one or more print layer(s), opaque layer(s) and adhesive layer(s) as described in U.S. Pat. Nos. 7,785,764, 8,613,988, 9,227,461 and 9,371,148 to form the substrate and layers of the multiple layered print structure **120**, the subject matter of which is incorporated in its entirety by reference into the disclosure of the present application.

[0071] In the foregoing description various embodiments of the invention have been presented for the purpose of illustration and description. With regard to recitations of fabric or cloth, it should be understood that such terms includes woven and non-woven fabrics as well as nylon and polyester fabrics and fabrics or cloths made from natural materials, and that embodiments of the present disclosure are in no way limited to a particular fabric or cloth. They are not intended to be exhaustive or to limit the invention to the precise form disclosed and include articles such as paper, wood, glass, and any other item. Obvious modifications or variations are possible in light of the above teachings. The embodiments were chosen and described to provide the best illustration of the principals of the invention and its practical application, and to enable one of ordinary skill in the art to utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated. All such modifications and variations are within the scope of the invention as determined by the appended claims when interpreted in accordance with the breadth they are fairly, legally, and equitably entitled.

Claims

1. A multiple layered print structure for transferring a design to a receptor, comprising: a removable substrate; an adhesive layer applied on top of the removable substrate, where the adhesive layer is applied substantially to the surface; at least one print layer printed on the adhesive layer using one digital ink-jet print method wherein the at least one print layer forms a design; where, at least one print layer comprising at least one opaque layer printed on the design using one digital ink-jet print method; whereby a portion of adhesive layer is co-extensive with the at least one print layer, and including the opaque layer, and are adapted to be separated from the removable substrate for transfer of the design to a receptor.

2. The multiple layer print structure of claim 1, wherein the design is in mirror image format.
3. The multiple layer print structure of claim 1, wherein the substrate is formed of a material adapted to withstand high temperatures.
4. The multiple layered print structure of claim 1, wherein the substrate is selected from at least one of a group comprising paper web, plastic film, wood pulp fiber paper, metal foil, parchment paper, lithographic printing paper, or clear film.
5. The multiple layer print structure of claim 1, wherein the adhesive layer is adapted to receive at least one print layer being printed using at least one digital ink-jet print method.
6. The multiple layer print structure of claim 1, wherein the adhesive layer further comprises a print receptive layer underlying said print layer, where the print receptive layer is adapted to receive at least one print layer being printed using at least one digital ink-jet print method.
7. The multiple layer print structure of claim 6, wherein the adhesive layer further comprises one or more layers, where these layers facilitate receiving of the said at least one print layer.
8. The multiple layered print structure of claim 1, wherein the adhesive is selected from a group of water activated adhesive, pressure-sensitive adhesive or heat-sensitive adhesive such as thermoplastic polymer, including a polyamide, polyolefin, polyester, or other copolymer and mixtures thereof.
9. The multiple layer print structure of claim 1, wherein the at least one print layer includes adhesive.
10. The multiple layer print structure of claim 1, wherein the at least one opaque print layer includes adhesive.
11. The multiple layer print structure of claim 1, wherein the at least one opaque print layer including adhesive facilitates easy release of print structure onto a receptor element.
12. A multiple layered print structure for transferring a design to a receptor, comprising: a removable substrate; an adhesive layer printed using one digital ink-jet print method on the substrate to create a shape profile; at least one print layer printed on the removable substrate using one digital ink-jet print method, wherein the at least one print layer forms a design; where, at least one print layer comprising at least one opaque layer on the design printed using one digital ink-jet print method; whereby, the adhesive layer, the at least one print layer, including the opaque layer, are adapted to be separated from the removable substrate for transfer of the design to a receptor.
13. The multiple layer print structure of claim 12, wherein the design is in mirror image format.
14. The multiple layer print structure of claim 12, wherein the substrate is formed of a material adapted to withstand high temperatures.
15. The multiple layered print structure of claim 12, wherein the substrate is selected from at least one of a group comprising paper web, plastic film, wood pulp fiber paper, metal foil, parchment paper, lithographic printing paper, or clear film.
16. The multiple layer print structure of claim 12, wherein the adhesive layer is adapted to receive at least one print layer being printed using at least one digital ink-jet print method.
17. The multiple layer print structure of claim 12, wherein the adhesive layer further comprises a print receptive layer underlying said print layer, where the print receptive layer is adapted to receive at least one print layer being printed using at least one digital ink-jet print method.
18. The multiple layer print structure of claim 17, wherein the adhesive layer further comprises one or more layers, where these layers facilitate receiving of the said at least one print layer.
19. The multiple layered print structure of claim 12, wherein the adhesive is selected from a group of water activated adhesive, pressure-sensitive adhesive or heat-sensitive adhesive such as thermoplastic polymer, including a polyamide, polyolefin, polyester, or other copolymer and mixtures thereof.
20. The multiple layer print structure of claim 12, wherein the adhesive is an ink-jet printable adhesive.
21. The multiple layer print structure of claim 12, wherein the at least one print layer includes

adhesive.
22. The multiple layer print structure of claim 12, wherein the at least one opaque print layer includes adhesive.
23. The multiple layer print structure of claim 12, wherein the at least one opaque print layer including adhesive facilitates easy release of print structure onto a receptor element.
24. A multiple layered print structure for transferring a design to a receptor, comprising: a removable substrate; an adhesive layer applied on top of the removable substrate, where the adhesive layer is applied substantially to the surface; at least one print layer formed with opaque or white layer printed on the adhesive layer using one digital ink-jet print method-wherein the at least one print layer forms a pre-set shape profile; whereby a portion of adhesive layer is co-extensive with the at least one print layer, and including the opaque layer, and are adapted to be separated from the removable substrate for transfer of the design to a receptor.
25. The multiple layer print structure of claim 24, further comprising at least one print layer underlaying the at least one opaque layer, wherein the print layer forms a design within the pre-set shape profile.
26. The multiple layer print structure of claim 24, wherein the design is in mirror image format.
27. The multiple layer print structure of claim 24, wherein the substrate is formed of a material adapted to withstand high temperatures.
28. The multiple layered print structure of claim 24, wherein the substrate is selected from at least one of a group comprising paper web, plastic film, wood pulp fiber paper, metal foil, parchment paper, lithographic printing paper, or clear film.
29. The multiple layer print structure of claim 24, wherein the adhesive layer is adapted to receive at least one print layer being printed using at least one digital ink-jet print method.
30. The multiple layer print structure of claim 24, wherein the adhesive layer further comprises a print receptive layer underlying said at least one print layer, where the print receptive layer is adapted to receive at least one print layer being printed using at least one digital ink-jet print method.
31. The multiple layer print structure of claim 30, wherein the adhesive layer further comprises one or more layers, where these layers facilitate receiving of the said at least one print layer.
32. The multiple layered print structure of claim 24, wherein the adhesive is selected from a group of water activated adhesive, pressure-sensitive adhesive or heat-sensitive adhesive such as thermoplastic polymer, including a polyamide, polyolefin, polyester, or other copolymer and mixtures thereof.
33. The multiple layer print structure of claim 24, wherein the at least one print layer includes adhesive.
34. The multiple layer print structure of claim 24, wherein the at least one print layer including adhesive facilitates easy release of print structure onto a receptor element.
35. A multiple layered print structure for transferring a design to a receptor, comprising: a removable substrate; an adhesive layer printed using one digital ink-jet print method on the substrate to create a shape profile; at least one print layer formed with opaque or white layer printed on the adhesive layer using one digital ink-jet print method-wherein the at least one print layer forms a pre-set shape profile; whereby the adhesive layer, and the at least one print layer are adapted to be separated from the removable substrate for transfer of the design to a receptor.
36. The multiple layer print structure of claim 35, wherein the design is in mirror image format.
37. The multiple layer print structure of claim 35, wherein the substrate is formed of a material adapted to withstand high temperatures.
38. The multiple layered print structure of claim 35, wherein the substrate is selected from at least one of a group comprising paper web, plastic film, wood pulp fiber paper, metal foil, parchment paper, lithographic printing paper, or clear film.
39. The multiple layer print structure of claim 35, wherein the adhesive layer is adapted to receive

at least one print layer being printed using at least one digital ink-jet print method.

40. The multiple layer print structure of claim 35, wherein the adhesive layer further comprises a print receptive layer underlying said at least one print layer, where the print receptive layer is adapted to receive at least one print layer being printed using at least one digital ink-jet print method.

41. The multiple layer print structure of claim 40, wherein the adhesive layer further comprises one or more layers, where these layers facilitate receiving of the said at least one print layer.

42. The multiple layered print structure of claim 35, wherein the adhesive is selected from a group of water activated adhesive, pressure-sensitive adhesive or heat-sensitive adhesive such as thermoplastic polymer, including a polyamide, polyolefin, polyester, or other copolymer and mixtures thereof.

43. The multiple layer print structure of claim 35, wherein the adhesive is an ink-jet printable adhesive.

44. The multiple layer print structure of claim 35, wherein the at least one print layer includes adhesive.

45. The multiple layer print structure of claim 35, wherein the at least one print layer including adhesive facilitates easy release of print structure onto a receptor element.