US 20060216491A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2006/0216491 A1

Ward et al. (43) Pub. Date: Sep. 28, 2006

(54) **BONDED STRUCTURES FORMED FORM MULTICOMPONENT FIBERS HAVING ELASTOMERIC COMPONENTS FOR USE AS INK RESERVOIRS**

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(21) Appl. No.: **11/378,065**

(22) Filed: **Mar. 17, 2006**

Related U.S. Application Data

(60) Provisional application No. 60/664,032, filed on Mar. 22, 2005. Provisional application No. 60/737,342, filed on Nov. 16, 2005.

Publication Classification

(51) **Int. Cl.**
D04H 13/00 (2006.01)

(52) **U.S. Cl.** **428/292.1**

(57) **ABSTRACT**

A bonded fiber ink reservoir, an ink jet printer cartridge containing a bonded fiber reservoir, and a ink jet printer using an ink jet cartridge containing a bonded fiber reservoir are disclosed. The bonded fiber reservoir may comprise a three dimensional bonded fiber structure, wherein the three dimensional bonded fiber structure is comprised of a plurality of fibers bonded to each other at spaced apart points of contact, at least a portion of the fibers being multicomponent fibers having at least one elastomeric fiber component.

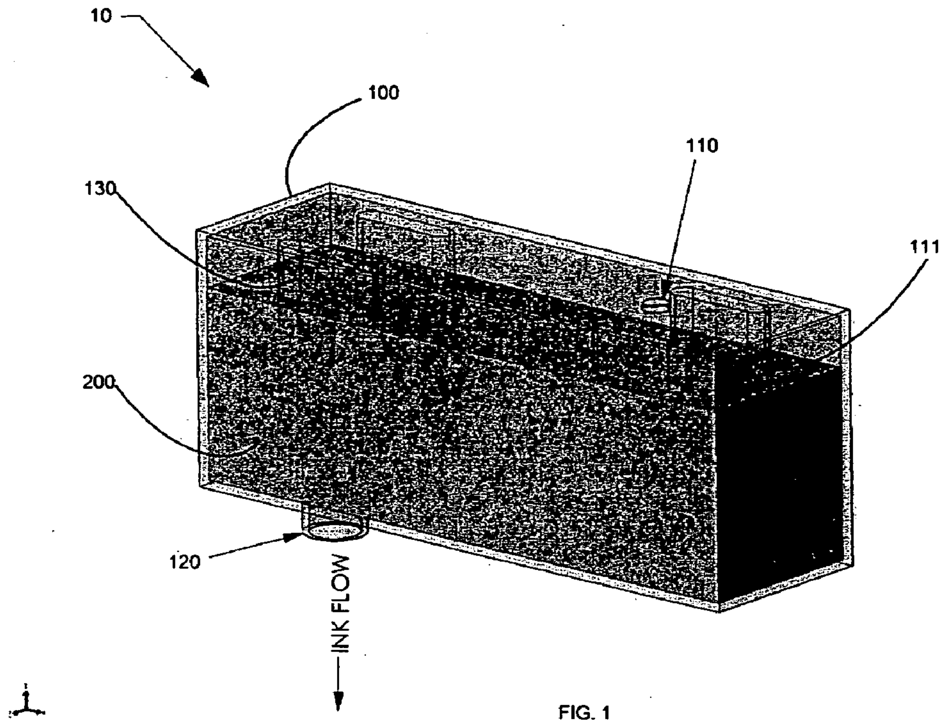
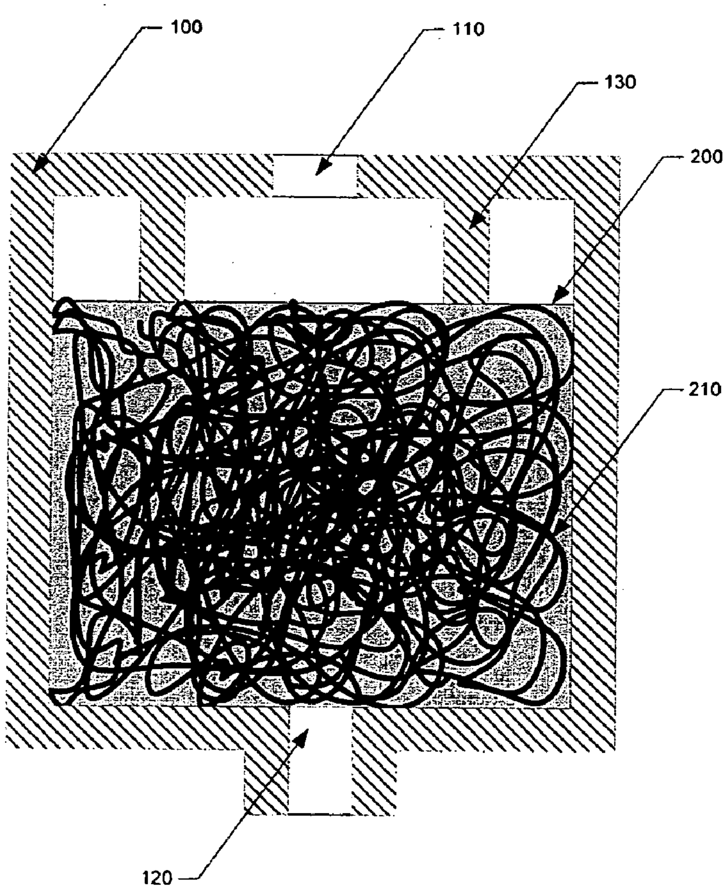


FIG. 1

FIG. 2



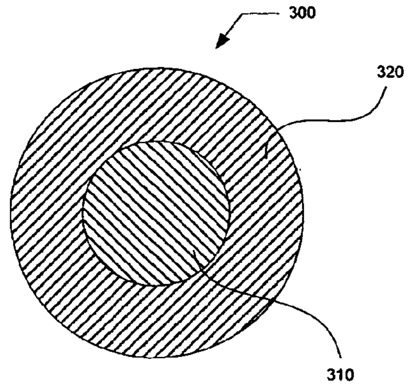


Fig. 3

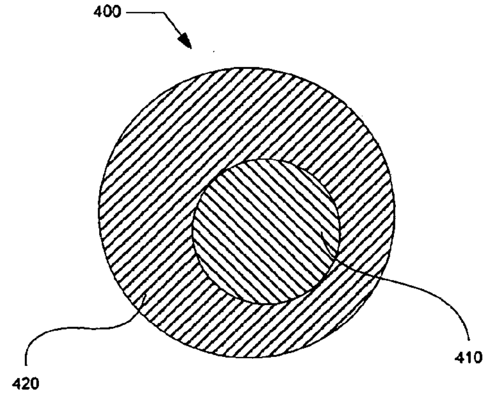


Fig. 4

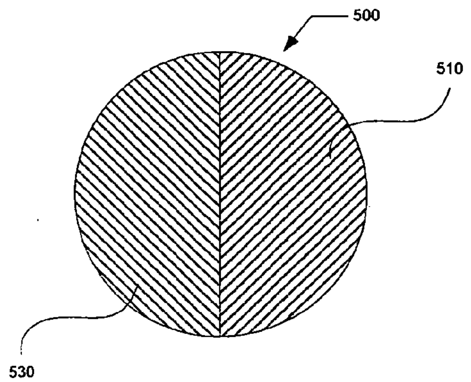


Fig. 5

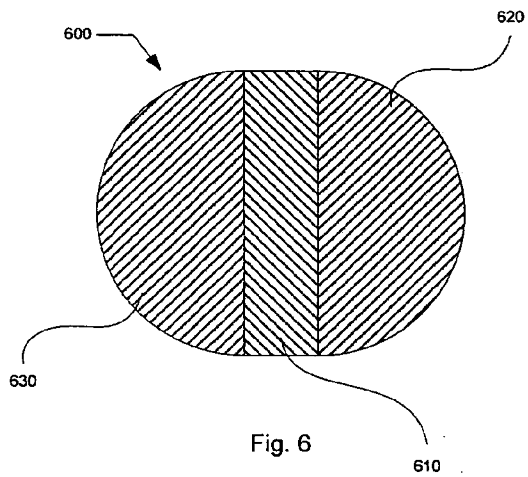


Fig. 6

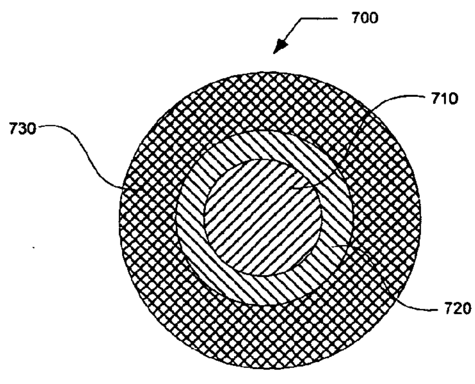


Fig. 7

BONDED STRUCTURES FORMED FORM MULTICOMPONENT FIBERS HAVING ELASTOMERIC COMPONENTS FOR USE AS INK RESERVOIRS

[0001] This application claims priority to U.S. Provisional Application Ser. No. 60/664,032, titled "Elastomeric Bicomponent Fibers and Bonded Structures Formed Therefrom," filed on Mar. 22, 2005, and U.S. Provisional Application Ser. No. 60/737,342, titled "Ink Reservoirs Formed From Elastomeric Bicomponent Fibers," filed on Nov. 16, 2005, both of which are incorporated herein by reference in their entirety.

BACKGROUND OF THE INVENTION

[0002] The invention relates generally to the field of multicomponent fibers and bonded fiber structures. More particularly, the invention is directed to three dimensional self-sustaining bonded fiber structures comprised of multicomponent elastomeric fibers. More particularly still, the invention relates to ink reservoirs formed of such three dimensional self-sustaining bonded fiber structures comprised of such elastomeric fibers.

[0003] Multicomponent fibers are typically manufactured by melt spinning techniques (including conventional melt spinning, melt blowing, spun bond, and other melt spun methods). Multicomponent fibers may be manufactured in a side-by-side structure, a centric sheath-core structure, or an acentric (e.g. self-crimping) sheath-core structure. Such fibers can be used in continuous filament or staple form and/or collected into webs or tows. They may be produced alone or as part of a mixed fiber system. Multicomponent fibers can be used for a variety of purposes, including but not limited to woven and non-woven fabrics or structures and bonded or non-bonded structures.

[0004] As described in U.S. Pat. Nos. 5,607,766, 5,620,641, 5,633,082, 6,103,181, 6,330,883, 6,814,911, and 6,840,692, each of which is incorporated herein by reference in its entirety, there are many forms of and uses for bonded fiber structures, as well as many methods of manufacture. In general, such bonded fiber structures are formed from tows or webs of thermoplastic fibrous material, where the bonded fiber structure comprises an interconnecting network of highly dispersed fibers bonded to each other at points of contact. These webs are formed into substantially self-sustaining, three-dimensional porous components and structures, which may be produced in a variety of sizes and shapes.

[0005] Porous, bonded structures formed from multicomponent fibers have demonstrated distinct advantages for fluid storage and fluid manipulation applications, because such bonded fiber structures have been shown to take up liquids of various formulations and controllably release them. A typical use for these structures may include use as nibs for writing instruments, ink reservoirs for writing instruments and/or ink jet printer cartridges, wicks for a wide variety of devices and applications, depth filters, and other applications where the characteristics of such structures are advantageous. Many of the advantageous characteristics of bonded fiber structures stem from the materials used in the fibers from which these structures are formed.

[0006] The above-referenced patents describe a wide variety of polymer materials that may be used to form fibers for use in three dimensional bonded structures. These structures, however, are often unsuitable for certain applications where resiliency or penetrability is required. Additionally, the ability of these structures to take up liquids of various formulations, hold these liquids during various environmental conditions, and controllably release these liquids is often less than desirable. Accordingly, there is a need for resilient bonded fiber structures that exhibit desirable fluid storage and manipulation characteristics.

[0007] These characteristics are desirable for ink jet printers. Ink jet printers often use an ink jet print-head mounted within a carriage. As the carriage moves across a media (i.e., paper), the ink jet print-head withdraws ink from an ink reservoir, and deposits the ink appropriately on the media (i.e., in the shape of letters). The ink reservoir is typically contained in an ink jet printer cartridge. The ink jet printer cartridge generally encases the ink reservoir. The ink jet printer cartridge may be disposed on the carriage adjacent to the print-head, or it may be disposed elsewhere in the ink jet printer and may deliver ink to the print-head.

[0008] Various materials may be used as the ink reservoir. Typical materials include open cell foam, and fibrous structures, such as felt. In selecting a material for the ink reservoir, several characteristics are considered. These characteristics primarily surround the material's fluid manipulation qualities. For example, capillarity strength, surface energy, porosity, leak resistance, resistance to imparting debris or extractibles into the ink, ease of assembly, and ink extraction may be examined.

[0009] However, these qualities must also be considered in light of various testing conditions. For example, ink jet printer cartridges must not leak during atmospheric pressure changes that may occur during shipping. Additionally, ink jet printer cartridges must not leak during certain impacts, such as if the ink jet printer cartridge is accidentally dropped. Finally, ink jet printer cartridges must deliver as much ink as possible to the print-head, rather than leaving unusable ink stranded in the cartridge.

[0010] Accordingly, it is desirable to find a material for use in an ink reservoir that retains ink during various environmental conditions, allows the ink to be easily extracted from the ink reservoir, and allows for the extraction of a high percentage of the ink.

SUMMARY OF THE INVENTION

[0011] Aspects of the invention include a bonded fiber ink reservoir, an ink jet printer cartridge containing a bonded fiber reservoir, and an ink jet printer using an ink jet cartridge containing a bonded fiber reservoir. The bonded fiber reservoir may comprise a three dimensional bonded fiber structure, wherein the three dimensional bonded fiber structure is comprised of a plurality of fibers bonded to each other at spaced apart points of contact, at least a portion of the fibers being multicomponent fibers having at least one elastomeric fiber component.

[0012] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only, and are not restrictive of the invention as claimed. The accompanying drawings constitute a part of the specification, illustrate certain embodiments of the invention and, together with the detailed description, serve to explain the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] In order to assist in the understanding of the invention, reference will now be made to the appended drawings, in which like reference characters refer to like elements. The drawings are exemplary only, and should not be construed as limiting the invention.

[0014] **FIG. 1** is an isometric view of an ink jet cartridge, in accordance with some embodiments of the invention.

[0015] **FIG. 2** is a cross-sectional view of an assembled ink jet cartridge, in accordance with some embodiments of the invention.

[0016] **FIG. 3** is a cross-sectional view of a concentric sheath-core multicomponent fiber, used to form three dimensional self-sustaining bonded fiber structures, in accordance with some embodiments of the invention.

[0017] **FIG. 4** is a cross-sectional view of an acentric sheath-core multicomponent fiber, used to form three dimensional self-sustaining bonded fiber structures, in accordance with some embodiments of the invention.

[0018] **FIG. 5** is a cross-sectional view of a side-by-side multicomponent fiber, used to form three dimensional self-sustaining bonded fiber structures, in accordance with some embodiments of the invention.

[0019] **FIG. 6** is a cross-sectional view of a multicomponent fiber, used to form three dimensional self-sustaining bonded fiber structures, in accordance with some embodiments of the invention.

[0020] **FIG. 7** is a cross-sectional view of a multicomponent fiber, used to form three dimensional self-sustaining bonded fiber structures, in accordance with some embodiments of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0021] Embodiments of the present invention provide multicomponent fibers having one or more elastomeric components that can be used to form resilient bonded fiber structures. As used herein, the term "multicomponent fiber" refers to a fiber having two or more distinct components integrally formed from polymer materials having different characteristics and/or different chemical nature. Bicomponent fibers are a particular type of multicomponent fiber. As used herein, the term "bicomponent fiber" refers to a fiber having two distinct components integrally formed from polymer materials having different characteristics and/or different chemical nature. While other forms of bicomponent fiber are possible, the most common types are formed with "side-by-side" or "sheath-core" relationships between the two polymer components. For example, bicomponent fibers comprising a core of one polymer and a coating or sheath of a different polymer are particularly desirable for many applications since the core material may be relatively inexpensive, providing the fiber with bulk and strength, while a relatively thin outer component of a more expensive but unique sheath material may provide the fiber with unique properties, particularly with respect to bonding.

[0022] As used herein, the term "elastomeric component multicomponent fiber" or "ECM fiber" means a multicomponent fiber having at least one component comprising an elastomeric material. The term "elastomeric component bicomponent fiber" means a bicomponent fiber having at least one component comprising an elastomeric material. As used herein the term "elastomeric material" refers to a macromolecular material that returns rapidly to its initial dimensions and shape after substantial deformation and release of stress.

[0023] As used herein, the term "fluid" means a substance whose molecules move freely past one another, including but not limited to a liquid or gas. The term "fluid" as used herein may also be multi-phase, and may include particulate matter suspended in a liquid or gas.

[0024] Reference will now be made in detail to embodiments of the invention, examples of which are illustrated in the accompanying drawings.

[0025] A particular application of three dimensional self-sustaining bonded fiber structures comprised of ECM fibers may be as an ink jet reservoir. Ink jet reservoirs made with ECM fibers have demonstrated several beneficial properties. For example, an ink jet cartridge using a reservoir according to embodiments of the invention has been shown to be resistant to leakage and has unexpectedly demonstrated a high degree of ink-release from the cartridge. Test data have indicated that reservoirs formed from ECM fibers may be used with a wide variety of ink formulations. Further, the specific chemistry of the ECM fibers used, including any finishes, may be tailored to provide a particular surface energy corresponding to the specific ink formulation with which they will be used.

[0026] Ink reservoirs comprised of bonded ECM fibers may be resilient, or resistant to taking a compressive set, and may therefore provide a material which has a high degree of conformance to the interior structure of an ink jet reservoir cartridge. This increased conformance may allow the reservoir to maintain contact with other ink conduit elements inside the cartridge. Maintaining contact to other such elements under severe environmental conditions (e.g., thermal shock, physical shock or vibration, repeated removal and loading of the cartridge from the printer, etc.) may reduce the likelihood of failure of the cartridge.

[0027] Ink reservoirs comprised of bonded ECM fibers, in accordance with some embodiments of the invention may also exhibit properties that assist in easier refilling. For example, the bonded fiber structure reservoir may be penetrated with a large filling needle, and may reseal when the needle is withdrawn. This may facilitate a more rapid filling that is conventionally achieved with standard, non-resilient fiber-based reservoirs.

[0028] With reference to **FIGS. 1 and 2**, an ink jet printer cartridge **10** in accordance with some embodiments of the invention will now be described. The ink jet printer cartridge **10**, may be generally comprised of a housing **100** and a reservoir **200**.

[0029] Ink jet housing **100** and associated reservoirs may be generally rectangular in shape, typically with 90 degree angles on all sides. The dimensions of the cartridge can typically range from less than 5 millimeters to 100 millimeters. A series of design considerations are often employed, which may include designing a cartridge which can hold 6 or more reservoirs and which will fit into typical ink jet printer designs. Non-rectangular shapes may also be employed, in which case, the reservoir(s) may be shaped accordingly.

[0030] The housing **100** may comprise an air vent **110**, a fluid outlet **120**, and stand-offs or baffles **130**. The air vent **110** may generally be disposed on the top surface of the housing **100**, and may allow air to vent into the housing **100**, thereby allowing the even flow of ink out of the housing **100**. A void **111** may exist near the air vent **110**, which may be used to contain ink that may flow out of the reservoir **200** due to environmental conditions. Additionally, the air vent **110** may be used, in certain types of ink jet printer cartridges, to fill the ink jet printer cartridge with ink during assembly.

[0031] The fluid outlet **120** may be disposed on the bottom of the housing **100**. The fluid outlet may contact a printer head or other device which may draw ink from the housing **100**. The outlet may contain a wick, which may draw the ink from the reservoir **200** via increased capillary strength. The stand-offs or baffles **130** may be shoulders or other detents integral to the housing, which may hold the reservoir **200** in a particular location.

[0032] The reservoir **200** may be comprised of a porous, three dimensional, self-sustaining bonded fiber structure formed from ECM fibers **210**. The bonded fiber structure reservoir **200** may have a certain capillary pressure that keeps ink inside the reservoir until drawn from the reservoir by either a print head pump or a higher capillary pressure wick. Additionally, the ink reservoir **200** may be designed to have enough capillary force to inhibit leakage as a result of mechanical shock or changes in atmospheric pressure.

[0033] The bonded fiber ink reservoir **200** may be cut to dimensions suitable for the housing **100**. These dimensions may be slightly oversized, in order to ensure a press-fit of the reservoir **200** in the housing **100**. The network of ECM fibers **210** that comprise the reservoir **200** retains and stores various formulations of ink through the ECM fiber's capillarity characteristics.

[0034] The methods of manufacture of ECM fibers and of three dimensional self-sustaining bonded fiber structures formed from ECM fibers are thoroughly discussed in Applicant's copending application, assigned Ser. No. ______ , filed on Mar. 14, 2006 under Attorney Docket Number 61633.001139, which is incorporated herein by reference in its entirety.

[0035] ECM fibers that may be used in some embodiments of the invention include (i) sheath-core multicomponent fibers where the sheath is comprised of an elastomeric material and the core is comprised of a non-elastic material; (ii) sheath-core multicomponent fiber where the sheath and the core are both comprised of elastomeric materials with the core material different physical and/or thermal characteristics from the sheath material; (iii) melt blown side-by-side bicomponent fibers, where one component is comprised of an elastomeric material; and (iv) melt blown side-by-side bicomponent fibers, where both components are comprised of elastomeric materials, and one component has different physical and/or thermal characteristics from the other.

[0036] With reference to **FIGS. 3-7**, various examples of ECM fiber embodiments according to the invention will now be discussed in more detail.

[0037] **FIG. 3** illustrates an exemplary ECM fiber of the invention. In this embodiment, the fiber is formed as a sheath-core bicomponent fiber **300** having a core component **310** surrounded by a sheath component **320**, wherein the sheath component comprises a thermoplastic elastomer. The use of an elastomer as the sheath component **320** is particularly advantageous in that elastomeric materials generally bond easily to one another and to other fiber materials. When bonded, the core component **310** of the sheath-core bicomponent ECM fiber **300** may provide strength and stability to the fiber, while the elastomeric sheath component **320** may allow the sheath-core bicomponent ECM fiber **300** to stretch relative to other fibers to which it is bonded. This stretchable bond may provide a resiliency to the bonded structure that is not attainable using conventional sheath-core fibers.

[0038] The sheath-to-core ratio of ECM fibers of the invention may be tailored depending on the particular materials, the application of the fibers, and the method of manufacture. Typical sheath-to-core volume ratios may be in a range from 10:90 to 90:10. In particular embodiments, the sheath-to-core volume ratio range from 25:75 to 40:60.

[0039] With continued reference to **FIG. 3**, the sheath-core bicomponent ECM fiber **300** is a concentric sheath-core fiber; that is, the sheath and core have substantially concentric circular cross-sections. Other ECM fibers according to the invention may be formed as acentric sheath core fibers as exemplified by the acentric sheath-core ECM fiber **400** shown in **FIG. 4**. The acentric sheath-core ECM fiber **400** has a sheath component **420** that comprises an elastomeric material and a core component **410**. In this fiber, the sheath and core components may be substantially circular in cross-section, but with offset centers. This acentric geometry may be used to produce a self-crimping fiber, which may facilitate the production of a loftier, bulkier, and more elastic web.

[0040] Melt-blown ECM fibers according to the invention may also be formed in a side-by-side configuration, as exemplified by the side-by-side ECM fiber **500** shown in **FIG. 5**. Like the sheath-core bicomponent ECM fiber **300**, the side-by-side ECM fiber **500** has a first component **510** that comprises an elastomer and a second component **530**. The side-by-side configuration assures that at least a portion of the surface of an elastomeric component **510** is exposed for bonding with other fibers.

[0041] ECM fibers of the invention are not limited to bicomponent fibers. For example, **FIG. 6** illustrates a multicomponent ECM fiber **600** according to the invention that has three components **610**, **620**, **630**, any one or more of which may comprise an elastomeric material.

[0042] ECM sheath-core fibers may also be produced with more than two components. With reference to **FIG. 7**, a multicomponent sheath-core ECM fiber **700** may be comprised of a sheath component **730** that comprises an elastomeric material, an intermediate component **720**, and a core component **710**. Similar fibers may be produced with acentric geometries.

[0043] The core components **310**, **410**, **710** of sheath-core ECM fibers **300**, **400**, **700**, the second component **510** of the side-by-side ECM fiber **500**, and the second and third components **620**, **630** of the side-by-side ECM fiber **600** may be non-elastomeric or may comprise elastomeric materials having different material and/or thermal characteristics from the elastomeric materials of the first fiber components **320**, **420**, **530**, **620**, **630** and **730**. In some embodiments, core components **310**, **410**, **710** and side-by-side components **530**, **620**, **630** may comprise a crystalline or semi-crystalline polymer. Such polymers may include, but are not limited to: polypropylene, polybutylene terephthalate, polyethylene terephthalate, high density polyethylene and polyamides such as nylon **6** and nylon **66**.

[0044] The various elastomeric components of the ECM fibers of the invention may comprise any suitable elastomeric material. Suitable thermoplastic elastomers may include, but are not limited to: polyurethanes, polyester copolymers, styrene copolymers, olefin copolymers, or any combination of these materials. More particularly, thermoplastic polyurethanes, thermoplastic ureas, elastomeric or plastomeric polypropylenes, styrene-butadiene copolymers, polyisoprene, polyisobutylene, polychloroprene, butadiene-acrylonitrile, elastomeric block olefinic copolymers (such as styrene-isoprene-styrene), elastomeric block co-polyether polyamides, elastomeric block copolyesters, and elastomeric silicones may be used.

[0045] Of these elastomeric materials, thermoplastic polyurethanes have been shown to be particularly suitable for producing ECM fibers for use in bonded fiber structures. As used herein, the term "thermoplastic polyurethane" or "TPU" encompasses a linear segmented block polymer composed of soft and hard segments, wherein the hard segments are either aromatic or aliphatic and the soft segments are either linear polyethers or polyesters. The defining chemicals of TPUs are diisocyanates, which react with short chain diols to form a linear hard polymer block. Aromatic hard segment blocks are usually based in aromatic diisocyanates, most commonly MDI (4,4'-Diphenylmethane diisocyanate). Aliphatic hard segment blocks are usually based in aliphatic diisocyanates, most commonly hydrogenated MDI (H12MDI). Linear polyether soft segment blocks commonly used include poly(butylene oxide) diols, poly(ethylene oxide) diols and poly(propylene oxide) diols or products of reactions of different glycols. Linear polyester soft segment bocks commonly used include the polycondensation product of adipic acid and short carbon-chain glycols. Polycaprolactones may also be used. Thermoplastic polyurethanes are commercially available from suppliers such as DuPont®, Bayer®, Dow®, Noveon®, and BASP®.

[0046] The particular elastomeric material selected for use in an ECM fiber may depend on a variety of factors including its spinning ability, bondability, the degree of resiliency required of the bonded fiber structure formed from the fiber, and other characteristics related to the use of the bonded fiber structure. A particular elastomeric material may be selected, for example, based on its relative hydrophobicity or hydrophilicity, or based on its compatibility with fluids or other materials expected to interact with the bonded fiber structure.

[0047] With any of the above-described ECM fiber embodiments **300**, **400**, **500**, **600**, **700**, care must be taken to assure that fiber integrity is maintained throughout the manufacturing process. ECM fibers of the invention may be produced using any of several methods, as detailed in co-pending U.S. patent application Ser. No. ______, filed on Mar. 14, 2006 under Attorney Docket Number 61633.001139. Regardless of the method of manufacture, however, specific processing parameters must be tailored to the particular materials used in order to assure that viable fibers are produced. In sheath-core ECM fibers, for example, processing parameters must be tailored to assure complete coverage of the core and to assure that the sheath will remain adhered to the core.

[0048] Variations and modifications can be made to the ECM fibers and bonded fiber reservoirs without departing from the scope of the invention. For example, as described in U.S. Pat. No. 6,814,911, fibers, fiber webs and products formed therefrom may require or may be enhanced by, the incorporation of an additive in the fibrous web during manufacture. Accordingly, surfactants or other chemical agents in particular concentrations may be added to the ECM fibers and/or ECM fiber webs to be used in the formation of ink reservoirs for ink jet printer cartridges. These additives may modify the surface characteristics of the ECM fibers to enhance absorptiveness and/or compatibility with particular ink formulations. Similarly, particulate matter may be adhered to the ECM fibers or ECM fibrous webs in order to produce certain characteristics (e.g., increase absorptiveness).

[0049] Additionally, bimodal webs comprising ECM fibers may be formed. Methods of forming such bimodal webs are described in U.S. Pat. No. 6,103,181. Bimodal webs are webs formed from a combination of fibers of different types, materials and/or configurations. For example, a first fiber type may be a sheath-core bicomponent ECM fiber in which the sheath material is an elastomer and the core is a non-elastomer, and a second fiber type may be an elastomeric or non-elastomeric monocomponent fiber. In some embodiments, a web may comprise a first sheath-core bicomponent ECM fiber in which the core material is an elastomer and the sheath may be a non-elastomer, and a second fiber type that may be a monocomponent fiber formed from the same elastomer as the core of the sheath-core bicomponent ECM fiber. In some embodiments, the fibrous web may be formed from alternating ECM fibers and multicomponent fibers with no elastomeric component. The bimodal fiber collection from any of these variations can be used to form a bonded web in which fibers of one type serve to bond to each other and to fibers of the other type.

[0050] It is contemplated that the ECM fibers used to form bonded ECM fiber structures may be in the form of bundled individual filaments, continuous filaments, filament tows, rovings of staple fibers, or lightly bonded or mechanically entangled webs or sheets of non-woven staple fibers. The ECM fibers may be mechanically crimped or may be structured so that self-crimping may be induced (e.g., by stretching and then relaxing the fibers) during the continuous forming process. Additionally, in some embodiments, substantially self-sustaining webs formed from ECM fibers may be post-drawn to create more elastic crimps along the machine direction. The additional crimps may help to generate a loftier, bulkier and more elastic substrate.

Testing Procedures

[0051] The ink leakage and ink extraction properties of some embodiments of ink reservoirs in accordance with the invention were determined by the following testing procedures:

Leak Testing Procedure

[0052] 1. Bonded ECM fiber reservoirs were placed in ink jet printer cartridges, and the reservoirs were loaded with 13.5 g of ink. Thirty (30) minutes were allowed for the ink to equilibrate in the cartridges.

[0053] 2. After the ink equilibrated in the cartridges, the cartridges were then dropped onto a hard surface from a height of approximately 1 meter on each face of the cartridge, for a total of six drops per cartridge. The cartridges were then checked for leakage. Any loss of ink from the reservoir and cartridge qualified as a failure.

[0054] 3. If the cartridges passed the leakage drop test, the cartridges were then subjected to vacuum leak testing. The cartridges were placed in a vacuum chamber with the cartridge tops facing downward and tested for leakage in the following manner:

[0055] a. The vacuum in the vacuum chamber was increased from 0.0 to 9.5 in Hg over 1 minute. This vacuum pressure was held for 2 minutes.

[0056] b. The vacuum in vacuum chamber was then increased from 9.5 to 12.5 in Hg over 1 minute. This pressure was held for 2 minutes.

[0057] 4. The vacuum was released and the cartridges were then removed from the vacuum chamber and checked for any evidence of leakage. Any visible loss of ink from the cartridge qualified as a failure.

Ink Extraction Testing Procedure

[0058] 1. Bonded ECM fiber reservoirs were placed in ink jet printer cartridges, and the reservoirs were loaded with 13.5 g of ink. Thirty (30) minutes were allowed for the ink to equilibrate in the cartridges.

[0059] 2. After the ink equilibrated in the cartridges, the initial mass of the cartridge was recorded.

[0060] 3. The cartridges were then placed in an ink extraction instrument, and ink was extracted as follows:

[0061] a. Ink was extracted at a rate of 2 mL/minute until a total of 4 mL was extracted.

[0062] b. Ink was then extracted at a rate of 1 mL/minute until a cumulative total of 5 mL was extracted.

[0063] c. Ink was then extracted at a rate of 0.5 mL/minute until a cumulative total of 5.5 mL was extracted.

[0064] d. Ink was then extracted at a rate of 0.25 mL/minute until 8 in. H_2O of backpressure was reached.

[0065] 4. After the ink was extracted from the cartridge, the final mass of the cartridge was recorded. Using the difference between the final mass and the initial mass, the extraction efficiency of the cartridge and reservoir were determined.

EXAMPLES

1) Ink Jet Printer Reservoirs Made From Melt-Blown Thermoplastic Polyurethane (TPU)/Polypropylene (PP) Sheath-Core Fibers

[0066] Melt-blown sheath-core bicomponent ECM fibers were formed using a thermoplastic polyurethane (TPU)(Noveon® Estane® 74280) as a sheath material and a polypropylene (PP) (Atofina® PP3860X, 100 melt flow rate ("MFR")) as a core material. The TPU was initially dried for 4 hours at 60° C. The sheath and core resins were melt-blown at temperatures ranging from 180°-245° C., with the die tip at 168° C. The ratio of TPU sheath material to PP core material was approximately 30:70 by volume. The resulting web displayed good bulk and softness. The produced web was passed through a steam forming die and a chilled forming die to form rectangular rods which were then cut to the desired length. The resultant bonded fiber structures were then inserted into ink jet printer cartridges, filled with ink, and tested for ink extraction and resistance to leaking. The testing procedures are discussed above. A matrix evaluating fiber size and reservoir densities was generated. (Table 1). A review of the results in Table 1 shows some embodiments of TPU-based ink reservoirs in accordance with the invention provide ink extraction performance well over 70%.

2) Ink Jet Printer Reservoirs Made From Melt-Blown Elastomeric Polypropylene (EPP)/Polypropvlene (PP) Sheath-Core Fibers

[0067] Melt-blown sheath-core bicomponent ECM fibers were formed using an elastomeric polypropylene (EPP) material (ExxonMobil® Vistamaxx® 2330) as the sheath material, and a PP material (Atofina® PP3860X) as the core material. The ratio of the sheath to core was approximately 30:70 by volume. The sheath and core resins were melt blown at temperatures in a range from 200-290° C., with the die tip at 277° C. Fiber sizes of approximately 9 micron were obtained. The resulting web displayed good bulk and softness. The produced web was then passed through a steam forming die to form rectangular rods which were then cut to the desired length. The resultant bonded fiber structures were then inserted into ink jet printer cartridges, filled with ink, and tested for ink extraction and resistance to leaking. The testing procedures are discussed above.

TABLE 1

Material (sheath-core) (30/70)	Fiber Size (micron)	Reservoir Density (g/cc)	Extraction (%) Cyan ink, (γ) 30 dyne/cm	Initial Back Pressure (in water)	Leaks (yes/no)
PET/PP	14.6	0.135	63.6	2.3	No
EPP/PP	9.0	0.131	54.0	5.8	No
EPP/PP	9.0	0.101	57.6	4.9	No
TPU/PP	14.6	0.160	75.3%	1.3	No
TPU/PP	14.6	0.127	74.1%	0.9	No
TPU/PP	13.4	0.132	69.6%	1.9	No
TPU/PP	13.4	0.145	66.1%	2	No
TPU/PP	13.4	0.183	62.3%	2.5	No
TPU/PP	10.5	0.132	69.9%	2.3	No
TPU/PP	10.5	0.160	65.5%	2.7	No
TPU/PP	10.5	0.186	58.9%	3.5	No
TPU/PP	26.7	0.105	77.1%	0.1	Yes
TPU/PP	26.7	0.132	76.7%	0.3	Yes
TPU/PP	26.7	0.161	72.1%	0.9	Yes
TPU/PP	26.7	0.183	67.6%	0.8	Yes
TPU/PP	18.0	0.136	73.8%	1	Yes
TPU/PP	18.0	0.161	71.3%	1.2	Yes
TPU/PP	18.0	0.186	67.3%	1.6	No

[0068] Table 2 provides relative ink absorption data, illustrating the amount of time required for inks of certain surface tension (γ) to be absorbed into the ECM fiber matrix. Values for inks at a series of surface tensions are provided for absorption into non-ECM fiber matrices (polyester sheathed sheath-core bicomponent fibers), sheath-core bicomponent ECM fibers with a hydrophobic TPU sheath material, and sheath-core bicomponent ECM fibers with a hydrophilic TPU sheath material.

TABLE 2

INK ABSORPTION DATA

Reservoir Characteristics			Ink Drop* (sec.)					
			HP 14 Cyan		Lexmark	Lexmark	Formulabs Canon	Formulabs Canon
Fiber Type	Fiber Size (mm)	Reservoir Density (g/cc)	Surface tension (γ) 30 dyne/cm	HP 14 Black γ 35 dyne/cm	12A1970 Black γ >42 dyne/cm	12A1912 Magenta γ 37 dyne/cm	BCI-21 Cyan γ 35 dyne/cm	BCI-21 Black γ 42.5 dyne/cm
TPU Estane 58245/PP Hydrophilic	11	0.168	1	1	35	1	1	2.5
TPU Estane 74280/PP Hydrophobic	15	0.155	1	>120	>120	40	1	>120
PET/PP	15	0.14	1	1	5	1	1	1

*"Ink drop" is the rate of absorption of a drop of ink into the cut end of the fiber matrix. A smaller number means faster absorption.

[0069] It will be apparent to those skilled in the art that various modifications and variations can be made in the method, manufacture, configuration, and/or use of the present invention without departing from the scope or spirit of the invention.

What is claimed is:

1. An ink reservoir, comprising a three dimensional bonded fiber structure, wherein the three dimensional bonded fiber structure is comprised of a plurality of fibers bonded to each other at spaced apart points of contact, at least a portion of the fibers being multicomponent fibers having at least one elastomeric fiber component.

2. The ink reservoir of claim 1, wherein the at least one elastomeric fiber component comprises a thermoplastic polyurethane.

3. The ink reservoir of claim 1, wherein the at least one elastomeric fiber component comprises a material selected from the group consisting of elastomeric and plastomeric polypropylenes, styrene-butadiene copolymers, polyisoprene, polyisobutylene, polychloroprene, butadiene-acrylonitrile, elastomeric block olefinic copolymers, elastomeric block co-polyether polyamides, elastomeric block copolyesters, poly(ether-urethane-urea), poly(ester-urethane-urea), and elastomeric silicones.

4. The ink reservoir of claim 1, wherein the multicomponent fibers are multicomponent fibers comprising:

a thermoplastic polymer core material; and

an elastomeric polymer sheath material surrounding the core material.

5. The ink reservoir of claim 4, wherein the elastomeric polymer sheath material comprises a thermoplastic polyurethane.

6. The ink reservoir of claim 4, wherein the thermoplastic core material comprises a second elastomeric material different from the elastomeric polymer sheath material.

7. The ink reservoir of claim 4, wherein the thermoplastic core material is selected from the group consisting of polyethylene, polypropylene, nylon, polyester, polybutylene terephthalate, and polyethylene terephthalate.

8. The ink reservoir of claim 1, wherein the multicomponent fibers are melt-blown side-by-side bicomponent fibers.

9. The ink reservoir of claim 1, wherein the three dimensional bonded fiber structure has at least one dimension along which the structure can be elongating at least 200% while retaining its structural integrity.

10. The ink reservoir of claim 1, wherein the fibers have a diameter in a range from about 1 micron to about 200 microns.

11. The ink reservoir of claim 1, wherein the fibers have a diameter in a range from about 1 micron to about 25 microns.

12. The ink reservoir of claim 1, wherein the fibers comprise materials that are selected, at least in part, for their compatibility with a particular ink formulation.

13. The ink reservoir of claim 1, wherein the bonded fiber structure is adapted to take up, hold, and controllably release a particular ink formulation.

14. An ink jet printer cartridge, comprising:

a housing, defining a reservoir cavity; and

a reservoir, disposed within the reservoir cavity, the reservoir comprising a three dimensional bonded fiber structure, wherein the three dimensional bonded fiber structure is comprised of a plurality of fibers bonded to each other at spaced apart points of contact, at least a portion of the fibers being multicomponent fibers having at least one elastomeric fiber component.

15. The ink jet printer cartridge of claim 14, wherein the at least one elastomeric fiber component comprises a thermoplastic polyurethane.

16. The ink jet printer cartridge of claim 14, wherein the at least one elastomeric fiber component comprises a material selected from the group consisting of elastomeric and plastomeric polypropylenes, styrene-butadiene copolymers, polyisoprene, polyisobutylene, polychloroprene, butadiene-acrylonitrile, elastomeric block olefinic copolymers, elastomeric block co-polyether polyamides, elastomeric block

copolyesters, poly(ether-urethane-urea), poly(ester-urethane-urea), and elastomeric silicones.

17. The ink jet printer cartridge of claim 14, wherein the multicomponent fibers are multicomponent fibers comprising:

a thermoplastic polymer core material; and

an elastomeric polymer sheath material surrounding the core material.

18. The ink jet printer cartridge of claim 17, wherein the elastomeric polymer sheath material comprises a thermoplastic polyurethane.

19. The ink jet printer cartridge of claim 17, wherein the thermoplastic core material comprises a second elastomeric material different from the elastomeric polymer sheath material.

20. The ink jet printer cartridge of claim 17, wherein the thermoplastic core material is selected from the group consisting of polyethylene, polypropylene, nylon, polyester, polybutylene terephthalate, and polyethylene terephthalate.

21. The ink jet printer cartridge of claim 14, wherein the multicomponent fibers are melt-blown side-by-side bicomponent fibers.

22. The ink jet printer cartridge of claim 14, wherein the three dimensional bonded fiber structure has at least one dimension along which the structure can be elongating at least 200% while retaining its structural integrity.

23. The ink jet printer cartridge of claim 14, wherein the fibers have a diameter in a range from about 1 micron to about 200 microns.

24. The ink jet printer cartridge of claim 14, wherein the fibers have a diameter in a range from about 1 micron to about 25 microns.

25. The ink jet printer cartridge of claim 14, wherein the fibers comprise materials that are selected, at least in part, for their compatibility with a particular ink formulation.

26. The ink jet printer cartridge of claim 14, wherein the bonded fiber structure is adapted to take up, hold, and controllably release a particular ink formulation.

27. An ink jet printer, comprising:

a carriage;

a print-head mounted on the carriage; and

an ink jet printer cartridge associated with the print-head, such that the ink jet printer cartridge provides the print-head with ink, and wherein the ink jet printer cartridge comprises an ink reservoir formed from a plurality of fibers bonded to each other at spaced apart points of contact, at least a portion of the fibers being multicomponent fibers having at least one elastomeric fiber component.

28. The ink jet printer of claim 27, wherein the multicomponent fibers are multicomponent fibers comprising:

a thermoplastic polymer core material; and

an elastomeric polymer sheath material surrounding the core material.

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