such as vinyl acetate or acrylates such as methyl and butylacrylate. Polyolefins are preferred because of their excellent physical properties, ease of processing, and typically lower cost than other thermoplastic materials having similar characteristics. Polyolefins readily replicate the surface of a casting or embossing roll. They are tough, durable and hold their shape well, thus making such films easy to handle after the casting or embossing process. Hydrophilic polyurethanes are also preferred for their physical properties and inherently high surface energy. Alternatively, fluid control films can be cast from thermosets (curable resin materials) such as polyurethanes, acrylates, epoxies and silicones, and cured by exposure radiation (e.g., thermal, UV or E-beam radiation, etc.) or moisture. These materials may contain various additives including surface energy modifiers (such as surfactants and hydrophilic polymers), plasticizers, antioxidants, pigments, release agents, antistatic agents and the like. Suitable fluid control films also can be manufactured using pressure sensitive adhesive materials. In some cases the channels may be formed using inorganic materials (e.g., glass, ceramics, or metals). Preferably, the fluid control film substantially retains its geometry and surface characteristics upon exposure to liquids.

[0061] Generally, the susceptibility of a solid surface to be wet out by a liquid is characterized by the contact angle that the liquid makes with the solid surface after being deposited on the horizontally disposed surface and allowed to stabilize thereon. It is sometimes referred to as the "static equilibrium contact angle", sometimes referred to herein merely as "contact angle".

[0062] As shown in **FIGS. 1***a* and **1***b*, the contact angle Theta is the angle between a line tangent to the surface of a bead of liquid on a surface at its point of contact to the surface and the plane of the surface. A bead of liquid whose tangent was perpendicular to the plane of the surface would have a contact angle of 90°. Typically, if the contact angle is 90° or less, as shown in **FIG. 1***a*, the solid surface is considered to be wet by the liquid. Surfaces on which drops of water or aqueous solutions exhibit a contact angle of less than 90° are commonly referred to as "hydrophilic". As used herein, "hydrophilic" is used only to refer to the surface characteristics of a material, i.e., that it is wet by aqueous solutions, and does not express whether or not the material absorbs aqueous solutions. Accordingly, a material may be referred to as hydrophilic whether or not a sheet of the material is impermeable or permeable to aqueous solutions. Thus, hydrophilic films used in fluid control films of the invention may be formed from films prepared from resin materials that are inherently hydrophilic, such as for example, poly(vinyl alcohol). Liquids which yield a contact angle of near zero on a surface are considered to completely wet out the surface. Polyolefins, however, are typically inherently hydrophobic, and the contact angle of a polyolefin film, such as polyethylene or polypropylene, with water is typically greater than 90°, such as shown in **FIG. 1***b*.

[0063] Depending on the nature of the microreplicated film material itself, and the nature of the liquid being transported, one may desire to adjust or modify the surface of the film in order to ensure sufficient capillary forces of the article. For example, the surface of the fluid control film may be modified in order to ensure it is sufficiently hydrophilic. Body liquids that will come into contact with the fluid control films of the present invention are aqueous. Thus, if fluid control films of the invention are to be used in applications involving such liquids, those films generally must be modified (e.g., by surface treatment, application of surface coatings or agents), or incorporation of selected agents, such that the film surface is rendered hydrophilic so as to exhibit a contact angle of 90° or less, thereby enhancing the wetting and liquid transport properties of the fluid control film. Suitable methods of making the surface hydrophilic include: (i) incorporation of a surfactant; (ii) incorporation or surface coating with a hydrophilic polymer; and (iii) treatment with a hydrophilic silane. Other methods are also envisioned.

[0064] The fluid control films of the invention may have a variety of topographies. Preferred fluid control films are comprised of a plurality of channels with V-shaped or rectangular cross-sections, and combinations of these, as well as structures that have secondary channels, i.e., channels within channels. For spontaneous wicking or transport along open channels, the desired contact angle of the microstructured surface/liquid interface of V-channeled fluid control films is such that:

$$\text{Theta} \leqq (90° - \text{Alpha}/2),$$

[0065] wherein Theta is the contact angle of the liquid with the film and Alpha (α) is the average included angle of the secondary V-channel notches. (See, e.g., **FIG. 2***g*).

[0066] Any suitable known method may be utilized to achieve a hydrophilic surface on fluid control films of the present invention. Surface treatments may be employed such as topical application of a surfactant, plasma treatment, vacuum deposition, polymerization of hydrophilic monomers, grafting hydrophilic moieties onto the film surface, corona or flame treatment, etc. Alternatively, a surfactant or other suitable agent may be blended with the resin as an internal characteristic altering additive at the time of film extrusion. It is typically preferred to incorporate a surfactant in the polymeric composition from which the fluid control film is made rather than rely upon topical application of a surfactant coating, since topically applied coatings may tend to fill in (i.e., blunt), the notches of the channels, thereby interfering with the desired liquid flow to which the invention is directed. When a coating is applied, it is preferably thin to facilitate a uniform thin layer on the structured surface. An illustrative example of a surfactant that can be incorporated in polyethylene fluid control films is TRITON™ X-100 (available from Union Carbide Corp., Danbury, Conn.), an octylphenoxypolyethoxyethanol nonionic surfactant, e.g., used at between about 0.1 and 0.5 weight percent. An illustrative method for surface modification of the films of the present invention is the topical application of a 1 percent aqueous solution of the reaction product comprising 90 weight percent or more of:

Formula 1