porous to air but seal when they come in contact with aqueous solutions (e.g., cellulose gum impregnated filters).

[0232] Preferred embodiments include a cartridge having a cartridge body with a first side and a second, preferably opposing, side and one or more cover layers mated to the first side to form a first fluidic network therebetween and one or more cover layers mated to the second side to form a second fluidic network therebetween. Through-holes through the cartridge body (which may be formed by molding, etching, machining, etc.) may be used to link the first and second fluidic networks and to provide Z-transitions. Additional fluidic complexity can be built into a cartridge by employing a laminated cartridge body having multiple cartridge body layers and additional fluidic networks between these layers; through-holes through the various cartridge body layers are used to link the different fluidic networks.

[0233] A high degree of control over the movement of liquids in the cartridges of the invention may be attained, without the introduction of active valve elements in the cartridge, through the use of fluidic networks comprising capillary breaks. "Capillary break", as used herein, refers to a region in a fluid conduit that acts as a barrier to liquid moving through the conduit under capillary action or under the driving force of a low pressure gradient below a threshold pressure. In preferred examples of capillary breaks, application of a pressure above the threshold pressure acts to push the fluid past the barrier. Capillary breaks may be designed into fluid conduits by introducing, e.g., i) a transition, on a surface of a conduit, from a wettable surface to a less wettable surface (e.g., as indicated by the contact angle for water); ii) a transition in conduit width from a region of narrow width that promotes capillary flow to a region of wider width; iii) a transition, on a surface of a conduit, in roughness; iv) a sharp angle or change in direction and/or v) a change in cross-sectional geometry. In another embodiment, a fluid conduit has a flexible wall/diaphragm that impinges into the conduit and blocks flow driven by a pressure below a threshold pressure. Application of a higher pressure forces the flexible wall/diaphragm out of the flow path and lets fluid flow. Preferably, the diaphragm is made of a material (e.g., Gortex) that allows gas to pass through but prevents the flow of liquid up to a certain pressure. Preferred capillary breaks involve a sharp angle or change in direction in a fluid conduit, most preferably a "Z-transition" as described above.

[0234] In one embodiment of the invention, a liquid is introduced into a chamber comprising an outlet conduit that includes a capillary break (preferably a Z-transition). The liquid enters the outlet conduit but stops at the Z-transition. A pressure gradient is then applied (e.g., by applying positive pressure to the chamber or negative pressure to the other end of the conduit) which cause the liquid to flow past the Z-transition into the rest of the conduit.

[0235] The fluidic paths in the fluidic networks of a cartridge may include one or more regions of higher hydrodynamic resistance. In such embodiments of the invention, it may be advantageous to configure the fluid paths in the cartridge and/or certain fluidic operations using the cartridge so that fluid slugs moving in/out of a region of higher hydrodynamic resistance maintain a near constant velocity under a constant driving pressure. In one non-limiting embodiment of the invention, a cartridge includes a detection chamber with inlet and outlet conduits, where the chamber has a higher hydrodynamic resistance than the input and output conduits, e.g., because it has a higher cross-sectional aspect ratio and/or a smaller cross-sectional area. High aspect ratio detection chambers may be advantageous, in certain applications, by providing a large optical window into the chamber and/or by increasing the area of a sensing surface relative to the volume of the detection chamber. Other regions in a cartridge that may have high hydrodynamic resistances include, but are not limited to, regions filled with filtration or chromatography media.

[0236] In certain embodiments of the invention, maintaining a controlled liquid velocity through a higher hydrodynamic resistance region is addressed by incorporating a hydrodynamic resistance matched fluid flow path in the fluidic network of the cartridge. The fluid flow path includes several fluidic regions (which may be or include fluidic conduits or chambers), that are linked together to form the fluid flow path. In one embodiment, the fluid flow path includes, in sequence, a first resistance region, a low resistance connecting region, and a matching resistance region. The fluid flow path may, optionally, also include a low resistance inlet region that provides a fluidic inlet to the first resistance region and/or a low resistance outlet region that provides a fluidic outlet to the matching resistance regions. Low and matching resistance, as used herein, are relative to the hydrodynamic resistance of the first resistance region.

[0237] The connecting region may be provided in the same plane as the first resistance region or it may be in a different plane relative to the other components of the flow path. For example, the connecting region may provide a Z-transition between the first resistance region and the matching resistance region. The connecting region is positioned at the exit orifice of the first resistance region. The matching resistance region, proximal to the connecting region and distal to the first resistance region, is located along the fluid flow path at the exit orifice of the connecting region.

[0238] The hydrodynamic resistance fluid flow path may be comprised within a fluidic network (e.g., a fluidic network within an assay cartridge) that comprises a metering component linked to the fluid flow path and configured to meter fluid slugs through the first resistance, connecting and matching resistance regions and optional inlet and/or outlet regions. The invention includes a method in which a slug of fluid is passed through the fluid flow path, preferably using air pressure or vacuum to drive the fluid movement. The fluid slug volume is greater than the volume of the first resistance region (V_r) and less than the combined volumes of the first resistance, connecting and matching regions ($V_r+V_c+V_m$). Thus, as the fluid slug moves through the fluid path, the loss of hydrodynamic resistance from movement of the trailing edge of the slug through the first resistance region is compensated by the increase in hydrodynamic resistance from movement of the leading edge of the slug into the matching region. The fluid therefore moves at a controlled velocity throughout the fluid flow path. In the absence of the matching region, a fluid slug being cleared from the first resistance region, under air pressure, will accelerate as the trailing edge moves through the region. Such acceleration could have detrimental effects on the performance of a fluidic network, e.g., by changing mass transport rates to surfaces in the fluid path and/or by preventing controlled de-wetting of surfaces at the trailing edge of a slug and, thereby, causing an increase in fluid left on the walls of the fluid path.