ticles such as magnetic beads, paramagnetic beads, solid phase extraction material, monoliths, or chromatography matrices.

[0081] A magnetic component (**109**) can be positioned such that magnetic particles in the cartridge reservoir (**107**) and/or the microfluidic chamber (**105**) are captured against a surface of the microfluidic chamber (**105**). The magnetic component can generate a magnetic and/or electromagnetic field using a permanent magnet and/or an electromagnet. If a permanent magnet is used, the magnet can be actuated in one or more directions to bring the magnet into proximity of the microfluidic chip to apply a magnetic field to the microfluidic chamber. In some embodiments of the invention, the magnet is actuated in the direction (**111**) indicated in FIG. **1**.

[0082] Alternatively, any of a variety of devices can be interfaced with the microfluidic chip. For example detectors, separation devices (e.g. gas chromatographs, capillary electrophoresis, mass spectrometers, etc), light sources, or temperature control devices can be positioned next to the microfluidic chip or used in conjunction with the microfluidic chip. These devices can allow for detection of analytes by detecting resistance, capacitance, light emission, or temperature. Alternatively, these devices can allow for light to be introduced to a region or area of the microfluidic chip.

[0083] A microfluidic device can be designed with multiple chambers that are configured for capture of magnetic particles. The multiple chambers and magnetic component can be arranged such that a magnetic field can be applied simultaneously to all chambers, or be applied to each or some chambers independent of other chambers. The arrangement of chambers and magnetic components can facilitate faster or more efficient recovery of magnetic particles. In particular, the arrangement can facilitate recovery of magnetic particles in multiple chambers.

[0084] As shown in FIG. **14**, the microfluidic chip (**103**) can be formed of a fluidics layer (**203**), an elastomeric layer (**205**), and a pneumatic layer (**207**). The fluidics layer can contain features such as a chamber (**105**), as well as channels, valves, and ports. The channels can be microfluidic channels used for the transfer of fluids between chambers and/or ports. The valves can be any type of valve used in microfluidic devices. In preferred embodiments of the invention, a valve includes a microscale on-chip valve (MOVe), also referred to as a microfluidic diaphragm valve herein. A series of three MOVes can form a MOVe pump. The MOVes and MOVe pumps can be actuated using pneumatics. Pneumatic sources can be internal or external to the microfluidic chip.

[0085] A MOVe diaphragm valve is shown in FIG. **15**. A cross-sectional view of a closed MOVe is shown in FIG. **15**A. A cross-sectional view of an open MOVe is shown in FIG. **15**B. FIG. **15**C shows a top-down view of the MOVe. A channel (**251**) that originates from a fluidic layer can interface with an elastomeric layer by one or more vias (**257**). The channel can have one or more seats (**255**) to obstruct flow through the channel when the elastomeric layer (**259**) is in contact with the seat (**255**). The elastomeric layer can either be normally in contact with the seat, or normally not in contact with the seat. Application of positive or negative pressure through a pneumatic line (**261**) to increase or decrease the pressure in pneumatic chambers (**253**) relative to the fluidic channel (**251**) can deform the elastomeric layer, such that the elastomeric layer is pushed against the seat or pulled away from the seat. In some embodiments of the invention, a MOVe does not have a seat, and fluid flow through the fluidic channel is not obstructed under application of positive or negative pressure. The vacuum that can be applied include extremely high vacuum, medium vacuum, low vacuum, house vacuum, and pressures such as 5 psi, 10 psi, 15 psi, 25 psi, 30 psi, 40 psi, 45 psi, and 50 psi.

[0086] Three MOVes in series can form a pump through the use of a first MOVe as an inlet valve, a second MOVe as a pumping valve, and a third MOVe as an outlet valve. Fluid can be moved through the series of MOVes by sequential opening and closing of the MOVes. For a fluid being supplied to an inlet valve, an exemplary sequence can include, starting from a state where all three MOVes are closed, (a) opening the inlet valve, (b) opening the pumping valve, (c) closing the inlet valve and opening the outlet valve, (d) closing the pumping valve, and (e) closing the outlet valve.

[0087] The fluidic layer (**203**) can be constructed of one or more layers of material. As shown in FIG. **16**, the fluidic layer (**203**) can be constructed of two layers of material. Channels (**301**, **303**, **305**) can be formed at the interface between the two layers of material, and a chamber (**105**) can be formed by complete removal of a portion of one layer of material. The channels can have any shape, e.g., rounded and on one side (**301**), rectangular (**303**), or circular (**305**). The channel can be formed by recesses in only one layer (**301**, **303**) or by recesses in both layers (**305**). The channels and chambers can be connected by fluidic channels that traverse the channels and chambers shown. Multidimensional microchips are also within the scope of the instant invention where fluidic channels and connections are made between multiple fluidic layers.

[0088] The thickness (**307**) of the second layer of material can be of any thickness. In some embodiments of the invention, the second layer has a thickness that minimizes reduction of a magnetic field in the chamber (**105**) that is applied across the second layer from an external magnetic component or minimizes reductions in heat transfer

[0089] As shown in FIG. **17**, the fluidic layer (**203**) can be constructed of a single layer of material. The single layer is then interfaced with an elastomeric layer, such that channels (**305**, **303**) and chambers (**305**) are formed between the fluidic layer and the elastomeric layer (**205**).

[0090] The microfluidic chip can be constructed from any material known to those skilled in the art. In some embodiments of the invention, the fluidics and pneumatic layer are constructed from glass and the elastomeric layer is formed from PDMS. In alternative embodiments, the elastomer can be replaced by a thin membrane of deformable material such as Teflon, silicon or other membrane. The features of the fluidics and pneumatic layer can be formed using any microfabrication technique known to those skilled in the art, such as patterning, etching, milling, molding, laser ablation, substrate deposition, chemical vapor deposition, or any combination thereof.

[0091] FIG. **18** and FIG. **19** show diagrams of a microfluidic chip. The microfluidic chip is a three layer chip comprising a glass-PDMS-glass sandwich. Referring to FIG. **18**, fluidic features can be etched and drilled into the top glass layer, and pneumatic features can be etched and drilled into the bottom glass layer. The dashed lines can be pneumatic layer features and the solid line can be fluidic layer features. Referring to FIG. **19**, the chip has four sections: Reagent Rail, Bead Rail, Processor **1**, and Processor **2**. The two rails and the two processors can be identical (mirrored) geometries. In some embodiments, the chip is configured so that either the