a mass **251** of a thermally responsive substance (TRS) that is relatively immobile at a first temperature and more mobile at a second temperature. A chamber **253** is in gaseous communication with mass **251**. Upon heating gas (e.g., air) in chamber **253** and heating mass **251** of TRS to the second temperature both utilizing for example a resistive heater in a heater array as shown in FIGS. **7-9**, gas pressure within chamber **253** moves mass **251** into channel **204** obstructing material from passing therealong. Other valves of component **201** have the same structure and operate in the same fashion as valve V**1**.

[0116] A mass of TRS can be an essentially solid mass or an agglomeration of smaller particles that cooperate to obstruct the passage. Examples of suitable materials for a TRS include a eutectic alloy (e.g., a solder), wax (e.g., an olefin), polymers, plastics, and combinations thereof. The first and second temperatures are insufficiently high to damage materials, such as polymer layers of cartridge **200**. Generally, the second temperature is less than about 90° C., and the first temperature is less than the second temperature (e.g., about 70° C. or less).

[0117] Valves for use with the present invention may be double valves or single valves. As seen in FIGS. **13**A and **13**B, double valves Vi' are also components that have a normally open state allowing material to pass along a channel from a position on one side of the valve (e.g., upstream of the valve) to a position on the other side of the valve (e.g., downstream of the valve). Taking double valve V**11**' of FIGS. **13**A and **13**B as an example, double valves Vi' include first and second masses **314**, **316** of a TRS (e.g., a eutectic alloy or wax) spaced apart from one another on either side of a channel. Typically, the TRS masses **314**, **316** are offset from one another (e.g., by a distance of about 50% of a width of the TRS masses or less). Material moving through the open valve passes between the first and second TRS masses **314**, **316**. Each TRS mass **314**, **316** is associated with a respective chamber **318**, **320**, which typically includes a gas (e.g., air).

[0118] The TRS masses **314**, **316** and chambers **318**, **320** of a double valve Vi' are preferably in thermal contact with a corresponding heat source of a heat source network such as depicted in FIGS. **7-9**. Actuating the corresponding heat source causes TRS masses **314**, **316** to transition to a more mobile second state (e.g., a partially melted state) and increases the pressure of gas within chambers **318**, **320**. The gas pressure drives TRS masses **314**, **316** across channel C**11** and closes valve HV**11**' (FIG. **13**B). Typically, masses **314**, **316** at least partially combine to form a mass **322** that obstructs channel C**11**.

[0119] In order to fit as many as 8 sample lanes or cartridges into a multi-lane cartridge, the double valves may be designed to take up less effective space on the cartridge. This can be achieved by adding bends to the channel containing the TRS.

Gates

[0120] A gate is a component that has a normally closed state that does not allow material to pass along a channel from a position on one side of the gate to a position on the other side of the gate. A gate is typically actuated (e.g., opened) to allow pressure created in the chamber of an actuator to enter the microfluidic component. Upon actuation, the gate transitions to an open state in which material is permitted to pass from one side of the gate (e.g., upstream of the gate) to the other side of the gate (e.g., downstream of the gate). An exemplary gate structure is shown in FIG. **12**, in connection with an actuator. For example, gate **242** includes a mass **271** of TRS positioned to obstruct passage of material between junction **255** and channel **240**. Upon heating mass **271** to the second temperature, the mass changes state (e.g., by melting, by dispersing, by fragmenting, and/or dissolving) to permit passage of material between junction **255** and channel **240**.

[0121] A gate is typically activated with an actuator in microfluidic devices known in the art. In the present invention, a gate is preferably actuated by pressure from an inlet such as the reagent inlet. An actuator is a component that provides a gas pressure that can move material (e.g., sample material and/or reagent material) between one location of component **201** and another location. For example, referring to FIG. **12**, actuator **244** includes a chamber **272** having a mass **273** of thermally expansive material (TEM) therein. When heated, the TEM expands thereby decreasing the free volume within chamber **272** and pressurizing the gas (e.g., air) surrounding mass **273** within chamber **272**. In some embodiments, actuator **244** can generate a pressure differential of more than about 3 psi (e.g., at least about 4 psi, at least about 5 psi) between the actuator and junction **255**.

[0122] The gates of the microfluidic component of the present invention may also be opened from a closed state to an open state by using pressure from an external source. In the present invention, the gates are preferably opened by forcing the various buffers from the reagent inlet by using external pressure provided by the system.

[0123] The TEM preferably includes a plurality of sealed liquid reservoirs (e.g., spheres) **275** dispersed within a carrier **277** as shown in FIG. **12**. Typically, the liquid is a high vapor pressure liquid (e.g., isobutane and/or isopentane) sealed within a casing (e.g., a polymeric casing formed of monomers such as vinylidene chloride, acrylonitrile and methylmethacrylate). Carrier **277** has properties (e.g., flexibility and/or an ability to soften (e.g., melt) at higher temperatures) that permit expansion of the reservoirs **275** without allowing the reservoirs to pass along channel **240**. In some embodiments, carrier **277** is a wax (e.g., an olefin) or a polymer with a suitable glass transition temperature. Typically, the reservoirs make up at least about 25 weight percent (e.g., at least about 35 weight percent, at least about 50 weight percent) of the TEM. In some embodiments, the reservoirs make up about 75 weight percent or less (e.g., about 65 weight percent or less, about 50 weight percent or less) of the TEM. Suitable sealed liquid reservoirs can be obtained from Expancel (Akzo Nobel).

[0124] When the TEM is heated (e.g., to a temperature of at least about 50° C. (e.g., to at least about 75° C., at least about 90° C.)), the liquid vaporizes and increases the volume of each sealed reservoir and of mass **273**. Carrier **277** softens, allowing mass **273** to expand. Typically, the TEM is heated to a temperature of less than about 150° C. (e.g., about 125° C. or less, about 110° C. or less, about 100° C. or less) during actuation. In some embodiments, the volume of the TEM expands by at least about 5 times (e.g., at least about 10 times, at least about 20 times, at least about 30 times).