

ratus, such as the molded microfluidic platform described herein, may be assembled with the specific binding assay apparatus by aligning the channel with corresponding sensing zones of the specific binding apparatus, the channel and its corresponding sensing zones being in fluid communication with one another, and securing the microfluidic platform and the specific binding assay apparatus to each other. The material of the microfluidic platform may seal directly onto a surface of the specific binding assay or an adhesive or sealant material may be employed.

[0022] As an alternative to the use of a mold to fabricate the microfluidic platform, micromachining processes (e.g., those used in semiconductor device fabrication) may be used to directly fabricate a microfluidic platform. Other known processes that would be suitable for fabricating the microfluidic platform are also within the scope of the present invention.

[0023] Other features and advantages of the present invention will become apparent to those of ordinary skill in the art through consideration of the ensuing description, the accompanying drawings, and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] In the drawings, which depict various aspects of exemplary embodiments of the present invention:

[0025] FIG. 1 is a bottom view of a microfluidic platform incorporating teachings of the present invention;

[0026] FIG. 2 is a cross-section taken along line 2-2 of FIG. 1, showing the microfluidic platform in an upright orientation;

[0027] FIG. 3 is a bottom view of an exemplary enlarged region of a channel of a microfluidic platform such as that shown in FIG. 1, depicting an exemplary type of mixing structure that may be used therein;

[0028] FIG. 4 is a bottom view of another exemplary enlarged region of a channel of a microfluidic platform such as that shown in FIG. 1, depicting another exemplary type of mixing structure that may be used therein;

[0029] FIGS. 5 and 5A are cross-sectional representation taken along line 5-5 of FIG. 1, depicting an examples of the manner in which the enlarged regions of the channel of the microfluidic platform may be configured;

[0030] FIGS. 6 through 6B are cross-sectional representations taken along line 6-6 of FIG. 1, showing examples of corrugated surfaces that may be included at the enlarged regions of the channel of the microfluidic platform;

[0031] FIGS. 7 through 10 schematically depict an exemplary method by which a microfluidic platform of the invention may be fabricated;

[0032] FIG. 11 depicts assembly of a separately formed microfluidic platform with a specific binding assay apparatus;

[0033] FIG. 12 is a schematic representation of a specific binding assay apparatus with which a microfluidic platform according to the present invention may be used; and

[0034] FIG. 13 is cross-section taken along line 13-13 of FIG. 10.

DETAILED DESCRIPTION OF THE INVENTION

[0035] With reference to FIGS. 1 and 2, an exemplary embodiment of microfluidic platform 10 according to the present invention is illustrated. Microfluidic platform 10 includes a substantially planar substrate 12 with opposite first and second surfaces 14 and 16, respectively. First surface 14 includes at least one elongate, nonlinear channel 18 therein and is configured to be secured to a reaction surface 52 of a specific binding assay apparatus 50 (FIGS. 1 and 2), while second surface 16 is depicted as being substantially planar. Microfluidic platform 10 may also include a sample reservoir 17 in communication with an end of channel 18.

[0036] As shown in FIG. 1, channel 18 takes a somewhat serpentine path and includes a plurality of transport regions 20 and discrete, enlarged regions 22 along the length thereof, with transport regions 20 being located between adjacent enlarged regions 22. Enlarged regions 22 are positioned along channel 18 so as to communicate with corresponding sensing zones 54 (FIGS. 10 and 11) of specific binding assay apparatus 50 when microfluidic platform 10 and specific binding assay apparatus 50 are mutually positioned in an assembled relationship.

[0037] Low cross-sectional microfluidic channels 18 incorporating teachings of the present invention may have dimensions of as small as about $25\ \mu\text{m} \times t$, where t is the channel depth, which may be as small as about $1\ \mu\text{m}$ to about $5\ \mu\text{m}$ or greater. The dimensions and configuration of each channel 18 may be adjusted to provide a particular flow rate and/or binding probability. The expected outcomes of studies using the channels are the minimum number of molecules in solution needed for detection, the minimum sample or sample solution volume that can be used, and the length of time required to introduce the sample or sample solution to each sensing zone of an array of sensing zones of a specific binding assay apparatus.

[0038] By way of example only, channel 18 may have a depth, or height, of about $70\ \mu\text{m}$ along substantially the entire length thereof, although other channel depths (e.g., about $25\ \mu\text{m}$ to about $70\ \mu\text{m}$) are also within the scope of the present invention. Each transport region 20 of channel may have a width of about $250\ \mu\text{m}$ or less (e.g., about $25\ \mu\text{m}$ to about $250\ \mu\text{m}$), while each enlarged region 22 may have a width of about $1\ \text{mm}$ or less (e.g., about $100\ \mu\text{m}$ to about $1\ \text{mm}$).

[0039] One or more mixing structures 24 may protrude into channel 18. As depicted, mixing structures 24 may be located at or near (e.g., upstream from) each enlarged region 22 of channel 18. Mixing structures 24 may be configured to create folding in a sample or sample solution as it flows through channel 18 and, thus, cause mixing and homogeneity of the constituents of the sample or sample solution.

[0040] FIGS. 3 and 4 depict exemplary configurations of mixing structures 24. In FIG. 3, mixing structures 24 comprise channel walls 25 that create convolutions in channel 18 at an enlarged region 22 thereof. FIG. 4 depicts a mixing structure 24 that includes a group of protrusions 26, or posts, that may have a pin-like or column-like appearance and which are positioned within an enlarged region 22 of channel 18. Alternatively, protrusions 26 may have a conical