SUMMARY

[0003] This document provides devices and methods for metering fluids. Assays on small amounts of sample can require precise metering of small volumes of sample and required reagents. Additionally, some assays rely upon the exclusion of air from an assay chamber. In some cases, the devices and methods provided herein can deliver a precise volume of one or more fluids. In some cases, the devices and methods provided herein can deliver multiple fluids to a common channel without the presence of air bubbles along the interface between fluids.

[0004] A device for metering fluids provided herein~~, in some cases,~~ includes a metering channel being ~~defined between~~having a metering inlet and a metering outlet, a loading channel having a loading inlet and intersecting the metering channel at a loading-metering intersection point, and an outflow channel having an outflow outlet and intersecting the metering channel at a metering-outflow intersection point. The metering channel can define a volume of fluid to be metered between the metering-outflow intersection point and the loading-metering intersection point.

[0004a] The inlets and outlets of the devices and systems provided herein can, in some cases, include valves to control the flow of fluids into and out of said devices. In some cases, the metering-outflow intersection point and/or the loading-metering intersection point can include a capillary-stop geometry to restrict fluid from heading down particular paths (e.g., when fluid is flowing due to capillary action).

[0005] A device for metering fluids provided herein, in some cases, includes a plurality of metering channels each having a metering inlet and each intersecting at least one of the other metering channels at one or more metering-metering

intersection points, an outflow channel having an outflow outlet and intersecting a first of said plurality of metering channel at a metering-outflow intersection point, and a loading channel having a loading inlet valve and intersecting a second of said plurality of metering channel at a loading-metering intersection point. Each metering channel can define a volume of fluid to be metered between ~~the~~ two ~~of the~~ intersection points.

[0005a] The inlets and outlets of the devices and systems provided herein can, in some cases, include valves to control the flow of fluids into and out of said devices. The metering-outflow intersection point, the loading-metering intersection point, and/or the one or more metering-metering intersection points can each have a capillary-stop geometries, which can restrict fluid from heading down particular paths (e.g., when fluid is flowing due to capillary action).

[0005b] A method for metering of fluids provided herein includes (a) introducing a metered fluid into a metering channel, the metering channel being defined between a metering inlet and a metering outlet, the metering channel intersecting an outflow channel at a metering-outflow intersection point and a loading channel at a loading-metering intersection point, wherein a portion of the metering channel between the metering-outflow intersection point and the loading-metering intersection point defines a metering portion having a predetermined volume; and (b) introducing fluid into the loading channel through a loading inlet valve introduce to push a loading fluid in the loading channel into the metering channel at the loading-metering intersection point and push the metered fluid in the meeting portion into the outflow channel.

[0005c] A method for metering a biological sample in a microfluidic diagnostic devices includes:

(a) introducing a biological sample into a sample inlet and into a biological

sample metering channel, the biological sample metering channel being defined between the sample inlet valve and a waste outlet valve, the biological sample metering channel intersecting an outflow channel at a metering-outflow intersection point and a reagent channel at a reagent-metering intersection point, wherein a portion of the biological sample metering channel between the metering-outflow intersection point and the reagent-metering intersection point defines a predetermined volume of biological sample to be delivered to a microfluidic diagnostic device;

(b) filling the reagent channel with a reagent, wherein excess reagent passes through the reagent-metering intersection point into the biological sample metering channel and through the waste outlet valve; and

(c) closing the sample inlet and the waste outlet valve; and

(d) introducing additional reagent into the reagent channel through a reagent inlet valve to push the reagent in the reagent channel into the biological sample metering channel at the reagent-metering intersection point and push the biological sample in the biological sample metering channel between the reagent-metering intersection point and the loading-metering intersection point into the outflow channel and into a microfluidic assay chamber.

[0006] A method for metering fluids provided herein, in some cases, includes delivering fluids in sequence to fill the metering channel with a metered fluid and a loading channel with a loading fluid followed by pushing the fluids out of the channels.

[0007] In some cases, filling the metering channel can include opening a metering inlet valve and a metering outlet valve, closing the other valves, and pumping or pulling the metered fluid into the metering channel. For example, by having the other valves closed, pressure within other channels can prevent the metered fluid from flowing into the other channels. In some

cases, filling the metering channel can include delivering a metered fluid to a metering inlet such that the metered fluid is wicked by capillary action through the metering channel. For example, the metering channel can be a microfluidic channel having a hydrophilic surface. In some cases, intersection points and/or the metering outlet