hole in the lid at the end of the outlet channel served as a waste reservoir. For each experiment, the channel arms were fixed to a length of 8 mm.

[0082] Flow Image Acquisition. Flourescence imaging of the rhodamine dye was performed using a research fluorescence microscope equipped with a 10× objective, a mercury arc lamp, a rhodamine filer set, and a video camera (COHU, San Diego, Calif.). Digital images were acquired using Scion Image™ software and a Scion LG-3 frame grabber (Scion, Inc., Frederick, Md.). For each experiment, images were captured every 1/60th of a second over a duration of 0.67 s, averaged, then recorded.

[0083] Experimental Set-up. To image the mixing under electroosmotic flow, the microchannels were initially filled with the carbonate buffer solution. Then, an equal amount (typically 40 μL) of buffer was placed in one inlet channel reservoir and in the outlet channel reservoir, while the second inlet reservoir was filled with the rhodamine-labeled buffer. Platinum electrodes were then placed in contact with the solution in the reservoirs such that the two inlet reservoirs were fixed to ground and the potential was applied to the outlet channel reservoir. The microchannel was placed beneath the fluorescence microscope described in the previous section, and images were acquired at several different applied voltages (0 to −1750V), beginning with zero applied voltage to verify that there was minimal flow resulting from hydrostatic pressure. The current through the microchannel was determined by measuring the voltage drop across a 100 kΩ resistor (typically less than 1/1000 the resistance of the microchannel) connected to the high voltage supply in series with the microchannel. For pressure driven flow studies, a programmable syringe pump (Harvard Apparatus PHD 2000, Holliston, Mass.) was interfaced to the stainless tubing in the inlet reservoirs via Teflon tubing.

[0084] The foregoing description of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed, and other modifications and variations may be possible in light of the above teachings. The embodiment was chosen and described in order to best explain the principles of the invention and its practical application to thereby enable others skilled in the art to best utilize the invention in various embodiments and various modifications as are suited to the particular use contemplated. It is intended that the appended claims be construed to include other alternative embodiments of the invention except insofar as limited by the prior art.

What is claimed is:

1. A mixer of laminar microfluidic streams propelled by electrokinetic flow comprising:

a first inlet channel;

a second inlet channel;

a mixing channel starting at the confluence of said first inlet channel and said second inlet channel; and

a plurality of wells disposed in said mixing channel, said wells being obliquely oriented substantially across the width of said mixing channel.

2. The mixer of claim 1 wherein alternating wells are configured perpendicular to each other.

3. The mixer of claim 1 wherein said wells are configured parallel to each other.

4. The mixer of claim 1 wherein at least a portion of the surfaces of said wells have an electroosmotic mobility that is different from the electroosmotic mobility of at least a portion of said mixing channel.

5. A splitter of a substantially laminar microfluidic stream comprising:

a splitting channel coupled to at least two inlet ports and at least one outlet port in which said substantially laminar microfluidic stream has an axis of flow; and

a plurality of wells disposed in said splitting channel, said wells being oriented substantially longitudinally across the width of said channel and diagonally across said axis of flow said wells being greater in depth than in width.

6. The splitter of claim 5 wherein alternating wells are configured perpendicular to each other.

7. The splitter of claim 5 wherein said wells are configured parallel to each other.

8. The splitter of claim 5 wherein said microfluidic streams are propelled by pressure.

9. The splitter of claim 5 wherein said microfluidic streams are propelled by electroosmosis.

10. The splitter of claim 5 wherein said microfluidic streams are propelled by electrokinetics.

11. The splitter of claim 5 wherein at least a portion of the surfaces of said wells have an electroosmotic mobility that is different from the electroosmotic mobility of at least a portion of said splitting channel.

12. A method of mixing two confluent laminar flows in microchannels comprising:

providing a first inlet stream and a second inlet stream that meet at a confluence point to produce a confluent stream;

passing said confluent stream through a mixing channel, said mixing channel comprising a plurality of wells, said wells being oriented substantially longitudinally across the width of said mixing channel and diagonally across said mixing channel, said wells being deeper in profile than in width; and

producing a mixed laminar flow at the output of said mixing channel.

13. The method of claim 12 wherein alternating wells are configured perpendicular to each other.

14. The method of claim 12 wherein said wells are configured parallel to each other.

15. The method of claim 12 wherein said microfluidic streams are propelled by pressure.

16. The method of claim 12 wherein said microfluidic streams are propelled by electrokinetics.

17. The method of claim 16 wherein at least a portion of the surface of said wells having an electroosmotic mobility that is different from at least a portion of the surface of said mixing channel.

18. The method of claim 12 wherein said first inlet stream comprises a plug of reagent.

* * * * *