

aqueous phase comprising an aqueous ethylenediamine solution was fed from the inlet port A to one side of the fine channel where the projections **20** were formed, at a rate of 10 $\mu\text{L}/\text{min}$, and an organic phase comprising a butanol solution of iodomethane was fed from the inlet port B at a flow rate of 3 $\mu\text{L}/\text{min}$. The reaction system is a reaction system that ethylenediamine reacts with iodomethane to synthesize N-methylenediamine to be extracted to the aqueous phase. In the observation of the fine channel supplied with each solution from each inlet port with a microscope, the fluid boundary formed by the aqueous phase and the organic phase was seen. The aqueous phase and the organic phase could be separated at the branch portion at a fluid outlet port side, and the aqueous phase was discharged from the outlet port C and the organic phase was discharged from the outlet port D without causing substantial mutual contamination. Further, when the aqueous phase discharged from the outlet port C was taken in a test tube to analyze it with a high-speed liquid chromatography, it was observed that the ratio of the amount of ethylenediamine to the amount of N-methylenediamine was about 90:10. The conversion of N-methylenediamine in the reaction was about 10%.

Example 5

[0155] In Example 5, a fine channel device having the construction as shown in FIG. 6(b) was used. A fine channel **19** was formed in the fine channel device to have two fine channel portions branched in a Y-letter like form at each side of fluid inlet and outlet ports. The width of the fine channel **19** was 240 μm , the depth was 60 μm and the length was 30 mm. In a substantially central portion of the fine channel, partition walls **22** having the maximum length of 50 μm and a height of 60 μm were formed intermittently in a flowing direction of fluid with intervals of 50 μm as shown in FIG. 6(a).

[0156] In the same manner as Example 1, the fine channel **19** was formed in a Pyrex (trademark) glass substrate **32** having a size of 70 mm \times 38 mm \times 1 mm (thick) according to conventional photolithographic and wet etching techniques, and a cover member **34** comprising a Pyrex (trademark) glass substrate having the same size as the fine channel substrate in which penetration orifices **35** having a diameter of 0.6 mm were formed mechanically at positions corresponding to inlet ports A **28**, B **29** and outlet ports C **30**, D **31**, was prepared. The cover member was thermally bonded on the fine channel substrate to seal hermitically the fine channel.

[0157] Methylation of ethylenediamine by iodomethane was conducted by using the fine channel device. Namely, an aqueous phase comprising an aqueous ethylenediamine solution in which fine silica particles having an average particle diameter of 5 μm were incorporated was fed from the inlet port A at a rate of 10 $\mu\text{L}/\text{min}$, and an organic phase comprising a butanol solution of iodomethane was fed from the inlet port B at a flow rate of 3 $\mu\text{L}/\text{min}$ in a flowing direction **27** shown in FIG. 20, respectively. The reaction system is a reaction system that ethylenediamine reacts with iodomethane to synthesize N-methylenediamine to be extracted to the aqueous phase. In the observation of the fine channel supplied with each solution from each inlet port with a microscope, the fluid boundary formed by the aqueous phase and the organic phase was seen. The aqueous

phase and the organic phase could be separated at the branch portion at a fluid outlet port side, and the aqueous phase was discharged from the outlet port C and the organic phase was discharged from the outlet port D without causing substantial mutual contamination. Further, when the aqueous phase discharged from the outlet port C was taken in a test tube to analyze it with a high-speed liquid chromatography, it was observed that the ratio of the amount of ethylenediamine to the amount of N-methylenediamine was about 90:10. The conversion of N-methylenediamine in the reaction was about 10%.

Example 6

[0158] In Example 6, a fine channel device having the construction as shown in FIG. 6(b) was used. A fine channel **19** was formed in the fine channel device to have two fine channel portions branched in a Y-letter like form at each side of fluid inlet and outlet ports. The width of the fine channel **19** was 240 μm , the depth was 60 μm and the length was 30 mm. The fine channel had an inner structure that partition walls **22** having a height of 60 μm were formed in a substantially central portion of the fine channel as shown in FIG. 6(a).

[0159] In the same manner as Example 1, the fine channel **19** was formed in a Pyrex (trademark) glass substrate **32** having a size of 70 mm \times 38 mm \times 1 mm (thick) according to conventional photolithographic and wet etching techniques, and a cover member **34** comprising a Pyrex (trademark) glass substrate having the same size as the fine channel substrate in which penetration orifices **35** having a diameter of 0.6 mm were formed mechanically at positions corresponding to inlet ports A **28**, B **29** and outlet ports C **30**, D **31**, was prepared. The cover member was thermally bonded on the fine channel substrate to seal hermitically the fine channel.

[0160] Methylation of ethylenediamine by iodomethane was conducted by using the fine channel device. Namely, an aqueous phase comprising an aqueous ethylenediamine solution was fed from the inlet port A at a rate of 10 $\mu\text{L}/\text{min}$, and an organic phase comprising a butanol solution of iodomethane was fed from the inlet port B at a flow rate of 3 $\mu\text{L}/\text{min}$. In the observation of the fine channel supplied with each solution from each inlet port with a microscope, the fluid boundary formed by the aqueous phase and the organic phase was seen. The aqueous phase and the organic phase could be separated at the branch portion at a fluid outlet port side, and the aqueous phase was discharged from the outlet port C and the organic phase was discharged from the outlet port D without causing substantial mutual contamination. Further, when the aqueous phase discharged from the outlet port C was taken in a test tube to analyze it with a high-speed liquid chromatography, it was observed that the ratio of the amount of ethylenediamine to the amount of N-methylenediamine was about 93:7. The conversion of N-methylenediamine in the reaction was about 7%.

[0161] From results of Examples 4, 5 and 6, it is understood that the present invention can provide a fine channel device having a fine structure capable of separating at least two kinds of fluid at the branch portion at a side of the fluid outlet port of the fine channel without causing substantial mutual contamination while said at least two kinds of fluid,