lost because the nature of the catalyst was changed when the catalyst in a suspension state by stirring contacted with the organic phase.

[0029] It is an object of the present invention to provide a fine channel device with a fine channel having such structure that when at least two kinds of fluid are supplied to the fine channel, adjacent flows of fluid provide a stable fluid boundary in the fine channel, and the adjacent flows of fluid can be discharged separately through predetermined outlet ports without causing the mutual contamination of fluid.

[0030] It is an object of the present invention to provide a chemically operating method wherein the mixing, chemical reaction, solvent extraction, separation, catalyst recovery and so on can effectively be carried out by supplying simply at least two kinds of fluid in a flowing direction to make adjacent flows of fluid at the fluid boundary formed by the adjacent flows of fluid in the fine channel.

[0031] Further, it is an object of the present invention to provide a fine channel device capable of recovering a catalyst in a course of chemical reaction in a multilayer type catalytic reaction without losing the activity of the catalyst, the recovered catalyst being reused and a chemically operating method using such fine channel device.

[0032] The inventors of the present application propose a fine channel device comprising a fine channel provided with at least two inlet ports for feeding fluid, inlet channels communicated with the inlet ports, a confluent portion communicated with the inlet channels, a branch portion communicated with the fine channel, from which at least two outlet channels are branched to feed predetermined amounts of fluid, and outlet ports communicated with the outlet channels, the fine channel device being characterized in that the fine channel is provided with a plurality of partition walls arranged along a boundary formed by at least two kinds of fluid fed from the inlet ports so as not to cause mutual contamination of fluid, and have completed the invention, to solve the problems of conventional techniques.

[0033] Further, the problems of conventional techniques can be solved by conducting chemical operations such as the mixing or chemical reaction of fluid, solvent extraction/separation, catalyst recovery and so on by using such fine channel device.

[0034] In this specification, the expression "the boundary formed by at least two kind of fluid" means "the fluid boundary".

[0035] As described before, when said at least two kinds of fluid are fed at a low flow rate to prolong a staying time, i.e., a time of chemical reaction or a time of solvent extraction, in the fine channel, there is apt to occur a change of the flow rate and a wraparound phenomenon of fluid. This facts imply, on the other hand, that as the length of the fine channel is smaller, possibilities of the positional variation of the fluid boundary and the wraparound phenomenon of fluid due to a difference of affinity between the inner wall of the fine channel and fluid to be supplied, are smaller. This can be considered because the positional variation of the fluid boundary is small since the distance of contact of fluid and the contact time of fluid are short, and the degree of the wraparound of fluid due to the difference of affinity between the inner wall of the fine channel and the fluid to be supplied is small.

[0036] Accordingly, when operations as described below are repeated, i.e., at least two kinds of fluid are made contact mutually in the fine channel; these kinds of fluid are separated in a state that the positional variation of the fluid boundary formed by such fluid is small, and the wraparound of fluid due to the difference of affinity between the inner wall and the fluid is small, and then, said at least two kinds of fluid are made again contact with each other, it can be expected that the fluid boundary is maintained stably over the entire length of the fine channel; the wraparound phenomenon of fluid due to the difference of affinity can be prevented, and the at least two kinds of fluid can be separated at the branch portion of the fine channel without causing the mutual contamination of fluid.

[0037] Accordingly, as a preferred embodiment of the present invention, there is provided a fine channel device comprising a fine channel provided with at least two inlet ports for feeding fluid, inlet channels communicated with the inlet ports, a confluent portion communicated with the inlet channels, a branch portion communicated with the fine channel, from which at least two outlet channels are branched to feed predetermined amounts of fluid, and outlet ports communicated with the outlet channels, the fine channel device being characterized in that the fine channel is provided with a plurality of partition walls arranged along a boundary formed by at least two kinds of fluid fed from the inlet ports so as not to cause mutual contamination of fluid wherein partition walls are located at positions apart from the confluent portion and the branch portion, and the plurality of partition walls have the same height as the depth of the fine channel.

[0038] Here, the fluid means liquid or gas. Further, the separation of the at least two kinds of fluid means that there is no substantial mixing of a kind of fluid to another kind of fluid, more specifically, percentage of the mutual contamination is 10% or less.

[0039] The fine channel is generally a channel of a size having a width of 500 $\mu$m or less and a depth of 300 $\mu$m or less. Although widths and depths of the inlet channels and the outlet channels are not in particular limited, they may have the same width and depth as the fine channel. Further, although sizes of the inlet ports and the outlet ports are not in particular limited, they may have a diameter of from about 0.1 to several mm. The vicinity of the confluent portion of the inlet channel means a position 10 $\mu$m-500 $\mu$m apart from the confluent portion, and the vicinity of the branch portion of the outlet channel means a position 10 $\mu$m-500 $\mu$m apart from the branch portion.

[0040] The fine channel device of the present invention has such structure that when at least two kinds of fluid obtained by dissolving a reactive material to be obtained or a material to be extracted in a medium such as water, an organic solvent or the like are supplied to a fine channel formed in the fine channel device, said at least two kinds of fluid are fed maintaining laminar flows in a small space of fine channel; said at least two kinds of fluid are made mutual contact to cause the mixing, chemical reaction of fluid or solvent extraction by the diffusion of molecules, and each kind of fluid can be supplied to a predetermined outlet channel through the fine channel.

[0041] Accordingly, in a preferred embodiment of the present invention, there is provided a fine channel device