[0065] **FIG. 10*d*** illustrates shims used to form a footer for collecting water vapor from a vaporizer body.

[0066] **FIGS. 10*e*-10*i*** illustrate a header and/or footer design that could be used for an air inlet and/or outlet in a vaporizer.

[0067] **FIG. 11** is a graph of data of vaporizer performance as a function of time.

[0068] **FIG. 12** shows a stack of 4 shim sets that can be cut to form **4** vaporizer bodies.

[0069] **FIG. 13** illustrates a shim set for making a device for operating with fluids at different pressures.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0070] FIGS. **4-5** illustrate a few shims that can be laminated to form devices (including components in devices); it should be understood that the examples are merely illustrative, the invention should not be understood to be limited to the illustrated embodiments. The devices (including components) would be difficult or impossible to construct using traditional shim designs for lamination procedures.

[0071] The shims in **FIG. 4**(*a*) have rows of circular apertures **402**, **404**, and **406**. In a typical operation, at least two of the rows are at a different temperature. The resulting tubular channels provide superior pressure resistance, strength and crack resistance. As with all the designs described herein, they are especially well-suited for use in microdevices. For example, each tubular channel can have a cross-sectional diameter of preferably less than 5 mm and more preferably less than 2 mm.

[0072] **FIG. 4*b*** illustrates a configuration particularly useful for heat exchange. Triangular channels **412** have adjacent channels **414** on all three sides. Thus, where **412** is at a different temperature than channels **414**—a highly effective heat transfer can be obtained. Also, diagonal walls can easily be constructed for heat transfer enhanced by high surface area between hot **420** and cold **422** channels.

[0073] **FIG. 4*c*** illustrates irregularly shaped apertures **430** and **433**. Aperture **433** is scalloped. The resulting channels can provide enhanced surface area for heat transfer, separation such as sorption, and/or catalysis (and, in some embodiments, turbulent flow). For example, channel **433** (formed by stacking multiple shims) could be coated with a catalyst composition (for example, an alumina wash coat followed by a metal impregnation or surface coating, not shown), while channel **430** is a heat exchange channel. In some preferred embodiments, shims have at least 2 irregularly shaped (i.e., not rectangular, not regular wave, etc.) apertures with conforming adjacent surfaces such as **435**, **437**—and laminated devices having channels with corresponding characteristics.

[0074] **FIG. 4*d*** shows apertures **440**, **442**, **444** and fins **441**, **443**, **445**. In this figure, the generally oblong apertures may be configured to alternate, from left-to-right, hot-cold-hot, etc.

[0075] **FIG. 4*e*** is a three dimensional representation of a device resulting from stacking shims shown in the center view of **FIG. 4**(*d*). The shims can be stacked with identical shims, alternating designs, or mixed in other selected or random patterns. In general, depending on the desired device characteristics, the ortho design principle allows easy stacking of identical or different shims (any type of aperture-containing shims), provided the shims are designed with some aligned apertures for fluid flow.

[0076] **FIG. 4*f*** illustrates a shim with multiple apertures **450**, **452** for higher surface area. Groups of apertures **454**, **456** can operate at different intergroup temperatures.

[0077] **FIG. 4*g*** illustrates a semi-ortho design for a reactor that includes integral heat recuperation of the reactant and product stream. The apertures **462** in the reactor section are created in the ortho style, where flow is substantially parallel to sheet thickness. The slots **464** in the reactor section are aligned to create an open flow channel and flow is substantially parallel to sheet width. The apertures **466** in the heat exchange section (e.g., a preheat section) are interleaved with walls to create a recuperative exchanger where flow is substantially parallel to sheet width. The reaction channels **464** are an example of quasi-ortho design illustrating another aspect of the present invention. In this embodiment, there are multiple (at least three) channels through which a straight, unobstructed line is present (the illustrated embodiment has a straight-through open channel). The reactor channel design (by itself) is not an ortho design because flow through the channel is substantially parallel to sheet width. This design allows communication with some mixing between multiple shims but has flow substantially parallel to sheet width. This design also demonstrates one general approach to integrating multiple unit operations within a device.

[0078] **FIG. 5*a*** is a similar arrangement as **FIG. 4*f***, except with circular apertures. **FIG. 5*b*** shows a shim with alternating rows of holes **510** and slits **512**. An advantage of mixing geometric shapes, such as holes and slots, may be realized for embodiments where a larger open area is desired for one flow path, and yet there is also a high interstream pressure differential. A larger open area may be advantageous for inserting a catalyst or for increasing the open area for flow and thus by reducing pressure drop.

[0079] **FIG. 5*c*** illustrates a shim that can be used to form a first component (in this case a circular aperture **520**) with a conformal second component (in this case a hemispherical aperture **522**). In a preferred embodiment, the shims are stacked to form a cylindrical tube into which a catalyst is added to form a reaction chamber, the conformal second component can be a heat exchange channel or a second reaction chamber designed to conduct a reaction having the opposite thermicity (for example, an endothermic reaction when the reaction in the cylindrical tube is exothermic).

[0080] In various embodiments, desired shims include one or more of the following shapes are formed in a shim: square, rectangle, parallelogram, circle, triangle, irregular shapes (i.e., shapes without symmetry or repeating units), waves, rectangles or squares or triangles with rounded corners, and ovals. These shims can be stacked and bonded to form 3 dimensional apertures (tubes) in shapes such as cylinders, prisms and waves. In some preferred embodiments 3 or more identical shims are stacked adjacent each other. In high pressure applications, cylindrical tubes are especially preferred. For good heat transfer, it is desirable to construct heat exchange channels in conformations that maximize surface contact to the areas of a device in need of