of vaporizing water with 1.5 ppm or greater of dissolved solids, it is preferred that pressure drop through the water channels increases by less than 5 psig after 1000 hours of operation. Alternatively, or additionally, the apparatus or methods could be characterized by a volumetric heat flux of 1 W/cm^3 or greater, optionally combined with other characteristics such as low pressure drop.

[0021] In yet another aspect, the invention provides a laminated device capable of transferring heat to or from a fluid passage within the device, that includes: a stack of shims that have been bonded together; wherein the stack of shims comprises a first component having dimensions of height, width and thickness; wherein at least a portion of the height of the first component is greater than 1 μm, at least a portion of the width of the first component is greater than 1 μm, and at least a portion of the thickness of the first component is greater than 1 μm; wherein height, width and thickness are mutually perpendicular; wherein the stack of shims comprises a second component having dimensions of height, width and thickness; wherein at least a portion of the height of the second component is greater than 1 μm, at least a portion of the width of the second component is greater than 1 μm, and at least a portion of the thickness of the second component is greater than 1 μm and wherein at least a portion of at least one of the height, width or thickness of the second component is less than 2 mm; wherein the directions of height, width and thickness are the same directions as the first component; wherein the stack comprises shims, wherein at least 3 adjacent shims contain at least one aperture within each shim, the apertures being defined by borders within each shim, and the second component is within or is formed by the at least one aperture in each of said at least 3 adjacent shims; and wherein the second component conforms to the first component in the directions of height, width and thickness. Shims that could be used to make such a device are illustrated, for example, in FIGS. **5**(*c*) and **6**(*c*). Components could be, for example, heat exchangers, reaction chambers, or any small device in need of heat exchange. The term "conforms" means more than merely two planar components, the second component conforms in three dimensions not just two dimensions. The invention also includes methods of making such devices and processes of using such devices to perform a unit operation such as a process of transferring heat.

[0022] The invention also includes methods of fluid processing in place of, or in addition to, any of the methods involving unit operations, where "fluid processing" includes mixing or any unit operation.

[0023] Of course, any of the aspects can be combined with additional features (such as in semi-ortho designs), and these are included in the above-described aspects. The invention also includes devices having any of the unique structural features or designs described herein. The invention also includes processes using any of the structural features or designs described herein.

[0024] Various embodiments of the present invention may possess some or all of the following advantages: low cost, rapid construction, and ease of design and manufacture. The ability to create circular or rounded microchannels through the use of shims in the ortho design allows for microdevices to be operated with large interstream pressure differentials. The pressure differential may range from 0 to hundreds of atm. A similar design with rectangular microchannels would have square corners and a higher stress concentration factor. To overcome this stress concentration factor for square-cornered microchannels, more metal would be required between the fluid streams or more structural support ribs would be required within the microchannel to support the pressure differential.

[0025] An additional advantage of some inventive embodiments is the ease of creating nonrectangular microchannels in the interleaved fluid orientation. Non-rectangular microchannels, such as the wavy channels shown in **FIG. 4***c* may be advantageous for improving heat transfer. In these channels, heat transfer may be enhanced by creating a boundary layer separation that increases convective heat transfer coefficients. Higher heat fluxes may be achieved when boundary layer separation occurs. Thus, the ortho style shims that create wavy or other irregular features are advantageous.

[0026] Other advantages of the ortho style shims and specifically the non-rectangular microchannels, is the ability to create a conformal microchannel around a device that needs to be cooled or heated. One example is for cooling electronics. Another example might be to heat or cool a cylindrical device with an ortho style exchanger. In these cases, the conformal microchannel created from the ortho design may be placed immediately adjacent to the object that requires heat transfer. The interleaved style described in **FIG. 1***b* could be used to create a conformal array of microchannels in alternating shims in a semicircular manner (see U.S. Pat. No. 6,129,973 there is a drawing to this effect), but these semi-circular flat-walled microchannels orient the flow paths in fins above the desired conformal object. Heat transfer through fins is always or nearly always less efficient than heat transfer through a wall as denoted by the use of a fin-efficiency whereby the total available surface area of the fins is discounted as it is less effective than the wall separating two fluid streams.

[0027] Another advantage of the ortho shim style is the option to create a structured or roughened surface for heat transfer. Such features act to separate or trip the boundary layer such that enhanced heat transfer may be achieved.

[0028] Examples of applications of various embodiments include, but are not limited to: the cooling of the electronic components with high heat generation rates, high power solid-state laser systems, heat exchange in micro propulsion systems and micro combustors, compact chemical reactors or processing systems, fuel cells, and air conditioning systems where the coolant channels should be located close to the heat source to remove generated heat of high density or to maintain a uniform solid wall temperature.

[0029] Glossary

[0030] The Following Section Will Contain Definitions of Claim Terms

[0031] The term "bonding" is not limited to diffusion bonding but includes any suitable method for sealing shims together.

[0032] By "devices" is meant entire laminated devices or laminated components that may be within a larger system.

[0033] A flow path "dimension (height or width)" refers to a dimension of a flow path (a flow path may also be called