15. The method of claim 13 wherein the catalyst comprises a combustion catalyst and the fluid is a reactant flowing through the microchannel at a Re of at least 1000.

16. A method of fluid processing in a microchannel, comprising:

flowing fluid through a microchannel at a Reynold's number Re of more than 100;

wherein the microchannel comprises surface features;

performing a unit operation on the fluid in the surface features;

wherein the unit operation comprises one or more unit operation selected from the group consisting of chemical reaction, vaporization, compression, chemical separation, distillation, condensation, heating, and cooling.

17. The method of claim 16 wherein the surface features comprise a series of at least 10 similar surface features, wherein each of the at least 10 similar surface features comprise at least one angle.

18. A method of fluid processing in a microchannel, comprising:

passing a fluid through a channel inlet into a microchannel;

wherein the microchannel comprises surface features in at least one surface feature section;

where more than 30% of the inlet mass of fluid enters the volume of the at least one surface feature in the surface feature section;

performing a unit operation on the fluid in the surface feature section;

wherein the unit operation comprises one or more unit operation selected from the group consisting of chemical reaction, vaporization, compression, chemical separation, distillation, condensation, heating, and cooling.

19. The method of claim 18 wherein the fluid passes through the microchannel with a contact time less than 100 ms.

20. A method of fluid processing in a microchannel, comprising:

providing microchannel apparatus comprising a microchannel;

wherein the microchannel comprises surface features;

wherein the surface features comprise at least 1 angle in each surface feature;

wherein a heat sink or heat source is in thermal contact with the active surface features;

flowing a fluid through the microchannel at a Re of more than 100;

resulting in heat transfer to or from the fluid flowing in the microchannel.

21. A method of fluid processing in a microchannel, comprising:

providing microchannel apparatus comprising a microchannel;

wherein the microchannel comprises a microchannel wall that comprises a section comprising surface features in thermal contact with a heat source or a heat sink;

flowing a fluid through the microchannel and exchanging heat through the at least one microchannel wall between the fluid and the heat source or sink;

wherein a pressure drop occurs over the section comprising surface features; and

wherein the heat transferred in the section divided by the heat transferred under identical conditions in a featureless section (h_{SF}/h_o) is at least 1.1 times as great as the pressure drop in the section divided by the pressure under identical conditions in a featureless section (dP_{SF}/dP_o).

22. A method of fluid processing in a microchannel, comprising:

providing microchannel apparatus comprising a microchannel;

wherein the microchannel comprises a first section and a second section;

wherein the first section comprises a first series of surface features;

wherein the second section comprises a second series of surface features; and

passing a fluid through the microchannel such that flow is mixed in the first and second sections, but relaxes to substantially parabolic flow between the sections.

23. The method of claim 22 wherein the first series of surface features comprise a first average feature depth;

wherein the second series of surface features comprise a second average feature depth;

wherein the first average feature depth and the second average feature depth are at least 20% different.

24. The method of claim 22 wherein a first unit operation occurs in the first section;

wherein a second unit operation occurs in the second section;

wherein the first unit operation is different than the second unit operation.

25. A method of making a laminated microchannel article, comprising:

stacking a first sheet with see-through surface features adjacent to a sheet comprising a microchannel such that the see-through surface features are disposed on one side of the microchannel; and

stacking a second sheet comprising cavities adjacent to the first sheet such that a cavity on the second sheet is adjacent to at least one see-through feature on the first sheet.

26. The method of claim 25 wherein the cavity is a see-through feature.

27. The method of claim 26 further comprising bonding the sheets and subsequently depositing a catalyst composition into the cavities.

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