CLAIMS

1. A co-current contactor for separating components in a fluid stream, the co-current contactor comprising:

a first inlet configured to receive the fluid stream proximate to a first end of the co-current contactor;

a second inlet configured to receive a solvent proximate the first end of the co-current contactor; and

a mass transfer section configured to receive the fluid stream and the solvent and to provide a mixed, two-phase flow;

wherein the mass transfer section comprises a surface feature on an inner wall of the mass transfer section, the surface feature configured to reduce film flow along the inner wall, and wherein the surface feature comprises a nonlinear surface irregularity, and wherein the non-linear surface irregularity comprises one of a curved texture, a scalloped texture, a ridged texture, a dimpled texture, a sawtooth texture, and a sandpaper texture.

2. A co-current contactor for separating components in a fluid stream, the co-current contactor comprising:

a first inlet configured to receive the fluid stream proximate a first end of the co-current contactor;

a second inlet configured to receive a solvent proximate the first end of the co-current contactor; and

a mass transfer section configured to receive the fluid stream and the solvent and to provide a mixed, two-phase flow;

wherein the mass transfer section comprises a surface feature on an inner wall of the mass transfer section, the surface feature configured to reduce film flow along the inner wall, and wherein the surface feature comprises a nonlinear surface irregularity, the nonlinear surface irregularity comprising a first raised surface and a second raised surface, each of the first and second raised surfaces having an impingement angle for directing a film flow away from the inner wall, and wherein the impingement angle of the first raised surface is greater than the impingement angle of the second raised surface.

3. A co-current contactor for separating components in a fluid stream, the co-current contactor comprising:

a first inlet configured to receive the fluid stream proximate a first end of the co-current contactor;

a second inlet configured to receive a solvent proximate the first end of the co-current contactor; and

a mass transfer section configured to receive the fluid stream and the solvent and to provide a mixed, two-phase flow;

wherein the mass transfer section comprises a surface feature on an inner surface of the mass transfer section, the surface feature configured to reduce film flow along an inner wall of the mass transfer section, and wherein the surface feature comprises a groove for directing flow along a path that is not parallel to a direction of flow of the two-phase flow.

4. The co-current contactor of claim 2, wherein the surface feature further comprises a nonlinear surface irregularity having a non-orthogonal impingement angle, and wherein the impingement angle is not parallel to the inner wall.

5. A method of separating components in a co-current contactor having the elements described in any one of claims 1-3, comprising:

passing a fluid into the co-current contactor;

passing a solvent into the co-current contactor;

placing the fluid in contact with the solvent to create a combined stream;

passing the combined stream through a mass transfer section of the co-current contactor;

impeding an amount of liquid from propagating along a wall of the mass transfer section using a surface feature disposed thereon; and

separating the fluid from the solvent.

6. The method of claim 5, wherein impeding the amount of liquid from propagating along the wall comprises impinging the amount of liquid on a surface such that the amount of liquid is directed radially inward.

7. The method of claim 5, wherein impeding the amount of liquid from propagating along the wall comprises directing the amount of liquid along a path that is not parallel to a direction of flow of the combined stream.

8. The method of claim 5, wherein impeding the amount of liquid from propagating along the wall comprises reducing the surface area of the amount of liquid contacting the wall.

9. A co-current contacting system for separating a contaminant from an initial gas stream, comprising:

a gas stream supply;

a solvent supply;

a first co-current contactor and a second co-current contactor arranged in a counter current configuration, wherein each co-current contactor is configured (i) to receive a gas stream and a liquid solvent, and (ii) to release a treated gas stream and a separate gas-treating solution; and

wherein each of the co-current contactors comprises the elements of any one of claims 1-3.