Claims

The claims are as follows:

[CLAIM 1]

A method of flow division and distribution of a stream to a process unit, the method comprising:

passing the stream through structured elements in the unit,

wherein the structured elements have a contact surface with a surface area ranging from 625 to 305,000 square meters per cubic meter of structured elements, the structured elements being present in an amount sufficient to facilitate flow division and distribution of the stream,

wherein the structured elements comprise one or more interconnected unit cells, each unit cell having a frame and a plurality of faces, wherein the individual faces can be open, partially open or entirely closed, wherein the frame and plurality of faces form a three dimensional structure which is a polyhedron, wherein the interconnected unit cells form a three dimensional structure, wherein the structured element includes a plurality of asperities formed on the unit cells, and

wherein the structured elements have a combined filtration and processing functionality able to effectively remove contaminants, and wherein the contact surface filters from the fluid stream filterable solids having a size in the range from 100 nanometers to 11 millimeters.

[CLAIM 2]

The method of claim 1, wherein the structured elements have a contact surface with a surface area of at least 10,000 square meters per cubic meter of structured elements.

[CLAIM 3]

The method of claim 1, wherein the structured elements have a contact surface with a surface area of up to 800,000 square meters per cubic meter of structured elements.

[CLAIM 4]

The method of claim 1, wherein the asperities comprise one or more of channels, flutes, spikes, fibrils and filaments.

[CLAIM 5]

The method of claim 1, wherein the contact surface comprises the surfaces of the frame, the surfaces of the asperities, and the surfaces of the faces.

[CLAIM 6]

A method of mitigation of undesired species from a stream to a unit, the method comprising:

passing the stream through structured elements in the unit, the structured elements being present in an amount sufficient to mitigate the undesired species in the stream; and

contacting the stream with the contact surfaces of the structured elements to mitigate the undesired species in the stream, wherein the structured elements have a contact surface with a surface area ranging from 625 to 305,000 square meters per cubic meter of structured elements,

wherein the structured elements comprise one or more interconnected unit cells, each unit cell having a frame and a plurality of faces, wherein the individual faces can be open,

partially open or entirely closed, wherein the frame and plurality of faces form a three dimensional structure which is a polyhedron, wherein the interconnected unit cells form a three dimensional structure, wherein the structured element includes a plurality of asperities formed on the unit cells, and

wherein the structured elements have a combined filtration and processing functionality able to effectively remove contaminants, and wherein the contact surface filters from the fluid stream filterable solids having a size in the range from 100 nanometers to 11 millimeters.

[CLAIM 7]

The method of claim 6, wherein the surfaces having geometrical properties which provide the capability to attract, retain and mitigate undesired species.

[CLAIM 8]

A method of facilitating flow division and distribution of a stream to a unit, the method comprising:

passing the stream through structured elements in the unit, the structured elements being in an amount sufficient to facilitate flow division and distribution of the stream; and

contacting the stream with the contact surfaces of the structured elements to facilitate flow division and distribution of the stream, wherein the structured elements have a contact surface with a surface area ranging from 625 to 305,000 square meters per cubic meter of structured elements,

wherein the structured elements comprise one or more interconnected unit cells, each unit cell having a frame and a plurality of faces, wherein the individual faces can be open, partially open or entirely closed, wherein the frame and plurality of faces form a three dimensional structure which is a polyhedron, wherein the interconnected unit cells form a

three dimensional structure, wherein the structured element includes a plurality of asperities formed on the unit cells, and

wherein the structured elements have a combined filtration and processing functionality able to effectively remove contaminants, and wherein the contact surface filters from the fluid stream filterable solids having a size in the range from 100 nanometers to 11 millimeters.

[CLAIM 9]

The method of claim 8, wherein the stream is an industrial process stream and the unit is an industrial process unit.

[CLAIM 10]

The method of claim 9, wherein the industrial process stream comprises hydrocarbons or inorganics.

[CLAIM 11]

The method of claim 9, wherein the industrial process unit comprises a hydrotreater, a still or an extractor.