Imagine TF TECH BRIEF

Nano and Micro Separation Technology

Imagine TF has invented, developed, and is licensing technology for use in microfluidic devices that can produce precise nanometer or micron-scale structures for separation.

Enabling the Future

Solve your challenging fluidic issues or enhance the performance of current systems with separation technology

Nano Precision

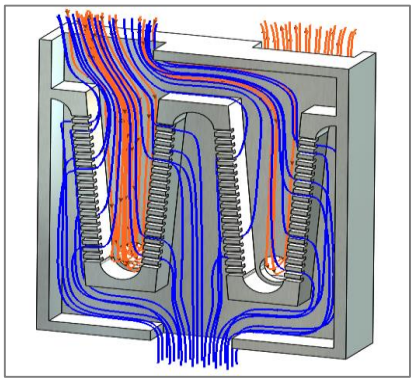
Precise fluidic structures fabricated with nanometer accuracy coupled with a unique separation concept

Simulation

Patterned architecture and geometric structures enable CFD and multiphysic simulations

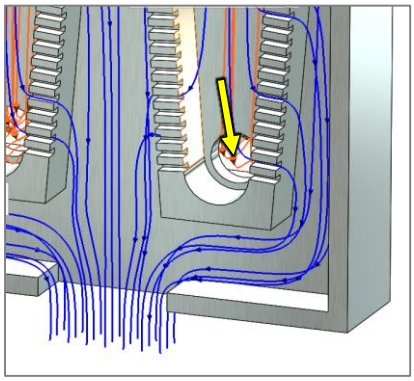
Proven, Low-Cost Production Techniques

Semiconductor, molding or printing manufacturing technology
for precision separation devices
produced at a low cost



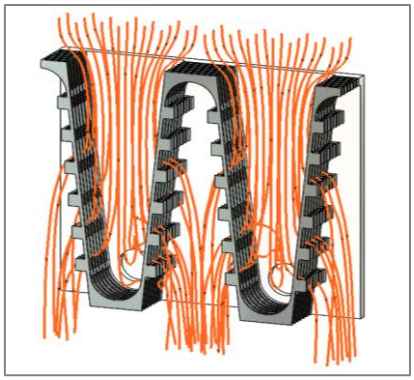
Separation architecture

Fluids flow along the surface of a substrate and are separated with pores in the V-shaped walls.



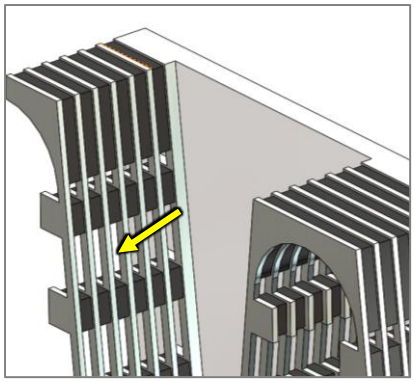
Separation close-up

A hole in the substrate allows the separated flow to be extracted from the fluid path.



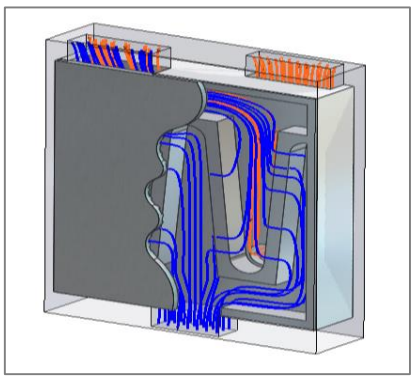
Layered Pores

Many layers of pores can be created on the surface of the substrate to increase flow



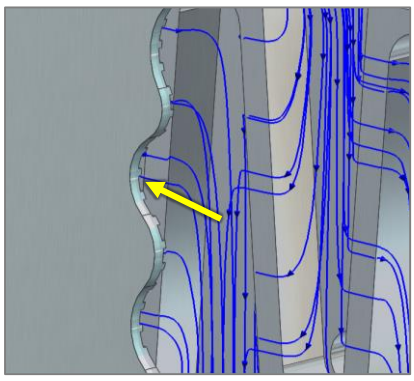
Layered pore close-up

Layered pores can be fabricated with atomic scale accuracy and size.



Slotted cover plate

An alternate way to create pores is to add slots on the backside of the cover plate.



Ribbed cover plate close-up

Slots in the cover plate create pores when mated to the V channels on the main plate.

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Fabrication

Many highly developed manufacturing processes can be applied to fabricate microfluidic separators.

Fabrication Processes

Many highly integrated manufacturing processes can be applied to fabricate separation structures. These include semiconductor, CD/DVD molding, roll to roll, conventional injection molding, stamping or ceramic casting. In many cases accuracy and size of features can be maintained within nanometers.

Process Steps

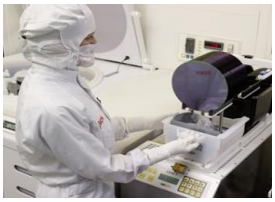
The steps to fabricate separation filters or tooling for the replication of filters are simple and have been highly developed for other industries.

"Lab on a Chip"

Separation elements can be inserted in or created within a larger fluidic system.

High Flow Applications

Chips can be arrayed for applications requiring high flow rates.

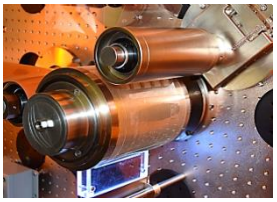


Semiconductor

Semiconductor processing equipment can be used to fabricate filters or tooling for molding. Nanometer accuracy is common.

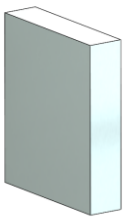
CD/DVD molded

CD/DVD molding equipment can be used. Tooling is made with semiconductor accuracy. A variety of coatings can be applied.



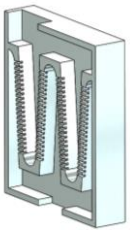
Roll to roll film

Roll to roll equipment can be used for low cost high volume applications. Tooling is made with semiconductor accuracy.



1. Substrate

A wide range of materials can be used as a substrate.

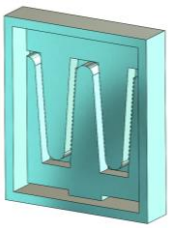


2. Etch

Etch away the main fluidic channels.

3. Backside etch

Etch the holes



Optional tooling

Molding or roll to roll tooling can be created from steps 1 to 3

Only a few steps are required to make filters or a mold with semiconductor equipment.

1. Substrate

A wide range of materials can be used as a substrate.

2. Layers

Deposit or laminate alternating types of materials.

3. Etch

Etch away the main fluidic channels.

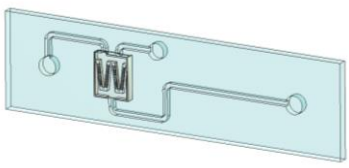
4. Open pores

Partially etch away one of the materials to create pores.

5. Etch holes

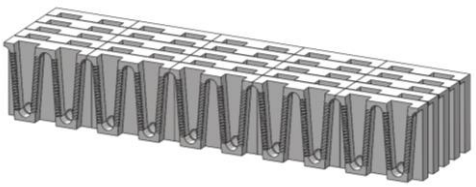
Etch holes from the backside.

By adding layers of semiconductor materials, laminated films, printed or electroplating separation structures can be created.



Low Flow Rate Applications

A small chip can be used in low flow applications, integrated into a more complex fluidic system.



High Flow Rate Applications

For high flow applications, chips can be larger in size and arrayed on top of one another

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Coatings, Materials & Examples

A wide range of materials can be used for or coated on microfluidic separators.

Materials and Coatings

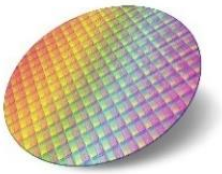
Almost all conventional materials can be applied to the devices with no need for new processes or development.

Surface functionalization

Enhance separation with material or coating or add an electric field with a conductor added to the fluidic surfaces. Functionalized or conductive surfaces can be applied to only specific locations if needed.

Proven Technology

Process development and fabrication of a number of devices have been demonstrated, with up to 60 layers with thicknesses between 10nm and 300nm.



Semiconductor

Silicon, Quartz, oxides, metals, polymers and more

Molded

Plastics of almost any type and metals

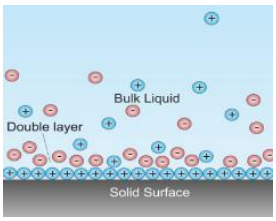
Films

Plastics films can be embossed or extruded

Other

Ceramics, formed metals and printed materials

A wide rage of materials can be processed and coated to create innovative devices for all types of processes in all types of environments

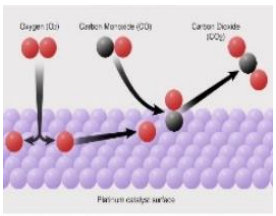


Charged surfaces

Created by the surface material or with an external voltage source

Surface tension

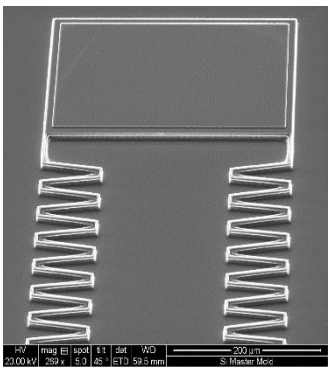
Create a hydrophobic or hydrophilic surface to enhance separation



Chemical

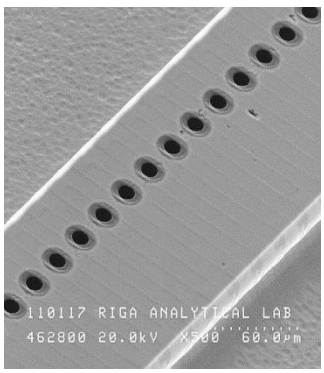
Add a catalyst to the surface to evoke a chemical reaction

Materials and/or coatings can be used to functionalize the fluid interface to enhance separation. An external electric potential can be applied to the fluid by adding conductive surfaces to the structures.



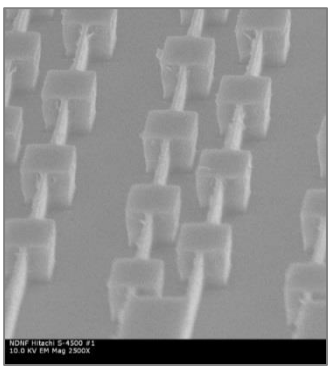
SEM of 200nm pores

Top view of 200nm pores. Silicon substrate replicated in plastic



Through holes

8µm holes in a device with 150nm pores



SEM of 80nm pores

Isometric view of 60 layers of 80nm pores

Examples of micro and nanometer scale devices

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