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Method and Process to Fabricate Hydrophobic Microchannels

A new fabrication technique creates hydrophobic surfaces on polymers and metals for microfluidic channels with structural controls, allowing for precise flow rate management without costly chemical treatments or complex external devices.

Hydrophobic polymer surfaces use surface roughness and textures to enhance hydrophobicity. The flow of fluids through device channels is usually controlled by external flow control devices, such as pumps and pressure generators; however, when flow rates through individual channels in the microfluidic device are varied, internal flow controls may be required. When it is not desirable to add flow control devices, the channel wall may be modified chemically or structurally. The many disadvantages of chemical treatment include the cost of procuring, storing, handling, and disposing chemicals; may make device unfit for some applications due to unwanted chemical reactions; and chemical coatings are prone to being washed away or wearing out over time. There is, therefore, a lack of a quick and inexpensive fabrication techniques to create microfluidic devices having channels with controllable flow rate without the use of chemical treatment or complex flow control devices.

Researchers at Purdue University have developed a new method of creating hydrophobic surfaces on polymers and metals for use in fabricating microfluidic devices with structured inner wall surfaces that provides control of flow rate in microfluidic channels. It may be used for applications where it is desired to have channels with a controllable flow rate, for microfluidic devices in which different channels have a different flow rate, or to separate different fluids or particles passing through the device. This technology may also be used in heat exchangers by removing condensed water drops, improving the heat transfer efficiency.

Advantages:

-Creates hydrophobic surfaces on polymers and metals

-Flow rate control and pressure control valves in fluidic channels

Technology ID

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Category

Energy & Power Systems/Hydrogen & Fuel Cell Systems

Materials Science & Nanotechnology/Advanced Functional Materials

Biotechnology & Life Sciences/Analytical & Diagnostic Instrumentation

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-Saves the cost associated with chemical treatment

Potential Applications:

-Cell biological research

-DNA analysis

-Inkjet printer heads

-Fuel cells

-Optofluidics

-Heat exchangers

TRL: 5

Intellectual Property:

Provisional-Patent, 2016-10-13, United States | Utility Patent, 2017-10-12, United States | DIV-Patent, 2020-12-24, United States

Keywords: Hydrophobic surfaces, polymer surface modification, microfluidic devices, flow rate control, internal flow control, structured channel walls, non-chemical surface treatment, fluidic channel valves, heat exchanger efficiency, DNA analysis