

# A Rapid, Directional, and Long-distance Micro Liquid Transport System

#### 🚓 Manufacturing

Biomedical and Genetic Engineering Buildings and Construction Technology Testing Instruments Waste Treatment/Management







Develop

Figure 2. The invented liquid diode could be applied at A. Different surface. B Different shape of pathway. C. Varied temperature condition. D. Different types of liquid.

#### Opportunity

Directed and spontaneous transport of a liquid on a solid surface is highly desired in various settings ranging from microfluidics, printing, loil-water separation, to water harvesting technologies. The principle detriment to the generation of such type of a fluidic motion arises from surface defects that pin the droplet edge thus thwarting its motion. Inspired by the distinct

Patent granted

**IP** Status

Proof

phenomenon of directional liquid transport on the peristome of pitcher plant, this invention is pertinent to the design and fabrication of a novel liquid diode consisting of U-shaped island arrays spatially confined in periodically patterned fences. Such a liquid diode endows a dominant propagation for various liquids in the lateral direction towards the opening of the U-shaped islands. This kind of liquid diode reveals a strong generality in the unidirectional liquid transport under various working regimes. The liquid can be transported along various pathways such as rings, circle and can climb up-hill without the use of external energy input.

#### Technology

The invention provides a unidirectional liquid transport system consisting of an array of elongate units configured in a grid format, with each unit surrounded by fencing. Each unit includes a region resembling a U-shaped micro-scale island with opening at the proximal end and an end on the opposite side. A channel between a lateral side of the island and an adjacent fencing is divergent from the proximal end on one side towards the distal location on the opposite side. The island includes a reentrant member configured to, upon contact with droplets of a liquid to be transported, initially arrest flow of the liquid and produce a pinning acting to allow building up of excess surface energy, and subsequently cause coalescence of the liquid thus converting the surface energy to kinetic energy for movement of the liquid. The surfaces of the units are fabricated on silicon wafer.

### Advantages

- The liquid can be transported along various pathways such as rings, circles
- The liquid can climb up hill without the use of external energy input
- Only slight decrease in the rectification coefficient when a temperature gradient is applied against the spreading direction
- Ease of fabrication
- Transport could be speedy, directional and in long distance

## Applications

- Water harvesting
- Heat management
- Ink jet printing
- Emulsion separation

Concep

Concept