AzTE Arizona Technology Enterprises

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Light-Driven Microfluidics

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Invention Description

The field of microfluidics covers a broad range of applications that deal with the motion of fluids at a micro-scale. Microfluidic systems comprising nozzles, pumps, reservoirs, mixers, valves, etc., can be used for a variety of applications including drug dispensing, ink-jet printing and general transport of liquid, gases and their mixtures. The field of microfluidics has entered an exciting stage of development and growth, and new discoveries are being made every day.

The invention presented here teaches how to construct a microfluidic device so that water and other fluids can be manipulated as drops or within microchannels using light. The basic elements of the invention include: (1) photoresponsive molecule; (2) film coating that maintains photoresponsivity of the molecule when applied to a surface and that permits light-induced control of wetting, surface energy; and (3) proper manipulation of surface roughness in order to magnify the photoresponsive contact angle change and to overcome contact angle hysteresis which would normally prevent water and other liquids from being driven by light.

For this new discovery, the ASU team theorized and proved that a change in water wettability – the ability of water molecules to easily move across a surface – when induced by light can be significantly amplified through a combination of very high nanoscale roughness and chemically coating the surface with molecules. The primary advance came with the realization that if the surface was roughened at the nanoscale, the 'Lotus leaf effect' could be obtained, and the small change in water repelling controlled by light could be magnified to a level that overcame hysteresis.

Development

Interdisciplinary research and development in microfluidics is gaining momentum at Arizona State University and across a number of related fields such as biodiagnostics, fuel cells, and MicroElectroMechanical Systems (MEMS). Active research continues in this area at ASU. At this time, AzTE is seeking potential collaborative and licensing partners for this technology.

Potential Applications

- **Biological Testing**
- **Chemical Analysis**
- **Drug Delivery & Pharma Research**
- **Movement of Liquids at sub-µL volumes**
- **Microreactor Feeds**
- **Microseparation and Purification**
- **Microprocessing of Liquids**
- **Non-mechanical Fluidic Valves**

Benefits and Advantages

- **Placement of microdroplets in predetermined positions for analysis**
- **Relatively inert process**
  - No potentially damaging electric fields
  - No air bubbles that can denature proteins
  - No moving parts that are expensive to make & difficult to repair
- **Regulate the flow of fluid on surfaces or in channels**