Magnetically Tunable Microstructured Surfaces
Technology #16368

Applications

Magnetically tunable microstructured surfaces can be used to improve liquid transport in microfluidics, cell manipulation in biological systems, and light tuning in optical applications. For example, micropillars containing cobalt nanowires have been used to apply forces to living cells, leading to different cellular reactions.

Problem Addressed

Dynamically tunable structures greatly extend manipulation capabilities in microfluidics, biological systems, and optical applications. Previous technologies were pH/temperature-sensitive and would contract or swell in response to a stimulus, which served as an “on-off” switch for chemical reactions. However, this approach is limited to a liquid environment. The proposed fabrication process creates magnetically tunable uniform micropillar arrays, where the tilt angle and direction can be controlled upon application of an external magnetic field. This is particularly attractive due to the non-intrusive nature of magnetic fields.

Technology

The fabrication process is seven-step: seed layer deposition, photoresist patterning, electroplating nickel, photoresist removal, silica deposition/thermal annealing, transferring to polydimethylsiloxane (PDMS), and etching the seed layer. Through this process, a uniform array covering an area of 8mm x 8mm is created, but can easily be scaled to >1cm². The surface consists of ferromagnetic micropillars with diameters of 24-27µm, heights of 60-80µm, and spacing of 60µm resting on a soft PDMS substrate to achieve high tilt angles. With a field strength of 0.5 tesla at a field angle of 60°, a uniform 10.5° to 20° tilt angle of the nickel pillar arrays is achieved. However, by changing the magnetic material to cobalt or permendur, the tilt angle can be increased while significantly decreasing the magnetic field strength.

Advantages

- Non-intrusive tunability of microstructured surfaces
- Scalable to areas > 1cm²

Categories For This Invention:

Materials
Micro & Nanotech
Intellectual Property:
Magnetically tunable microstructured surfaces
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Publications:
Real-Time Manipulation with Magnetically Tunable Structures
Advanced Materials
2014
Design and Fabrication of Magnetically Tunable Microstructured Surfaces
Transducers & Eurosensors XXVII
June 16, 2013

External Links:
Device Research Laboratory
http://drl.mit.edu/

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