

Applications of Magnetic Microstructures to Cell Patterning and Cell Manipulations

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Abstract

Manipulating cells in specific positions is a very important issue for the biological and biomedical applications. In this study we demonstrated the cell patterning through controlling the micromagnetic states in zigzag and concentric rings ferromagnetic thin films and a magnetic gripper through controlling the magnetic torque to the mechanical zigzag structure. In the cell patterning study, by controlling the positions of magnetic domain walls in patterned magnetic thin films, the patterning of magnetic cells can be achieved. The effects of cell patterning differ for magnetic films at as-deposited state and at remanent states after applying fields in different directions were discussed in zigzag magnetic films. Cells can be arranged at any positions in sequence by selectively changing the magnetic field directions of concentric magnetic rings. In the cell manipulation study, cell gripper based on two highly flexible magnetic zigzag structures that can be actuated by a magnetic field. We utilized the single domain characteristic of the films and the torque to actuate the zigzag structures. The actuation of the zigzag structures can be controlled by adjusting the magnitude and direction of the external magnetic field. Displacement of the zigzag structure measured under different magnetic fields was recorded and discussed. Furthermore, we demonstrated the ability of gripping a single cell in water solution using the designed cell microgripper.