Supplementary Material

Adhesion performance of magnetically responsive surfaces in wet condition

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The device for preparation of micropillars with flat terminals

The micropillars with flat terminals are prepared by a non-magnetic preparation device as shown in Figure S1. The magnet and the developed surface with pointed arrays (before the process of cured) can be freely disassembled and installed in the tray. The adjusting screw is made of brass and drives the tray up or down by 0.5 mm every clockwise or counterclockwise rotation. By adjusting the adjusting screw, the distance between the micropillars and the top pressing plate can be controlled to form flat terminal micropillars and adjust their sizes. The guide shaft plays a role in fixing the position of linear bearing movement. The pressing plate is made of polytetrafluoroethylene (PTFE) and exerts pressure on the micropillars. In addition, in order to avoid the influence on the magnetic field, all parts of the device are made of non-magnetic materials.

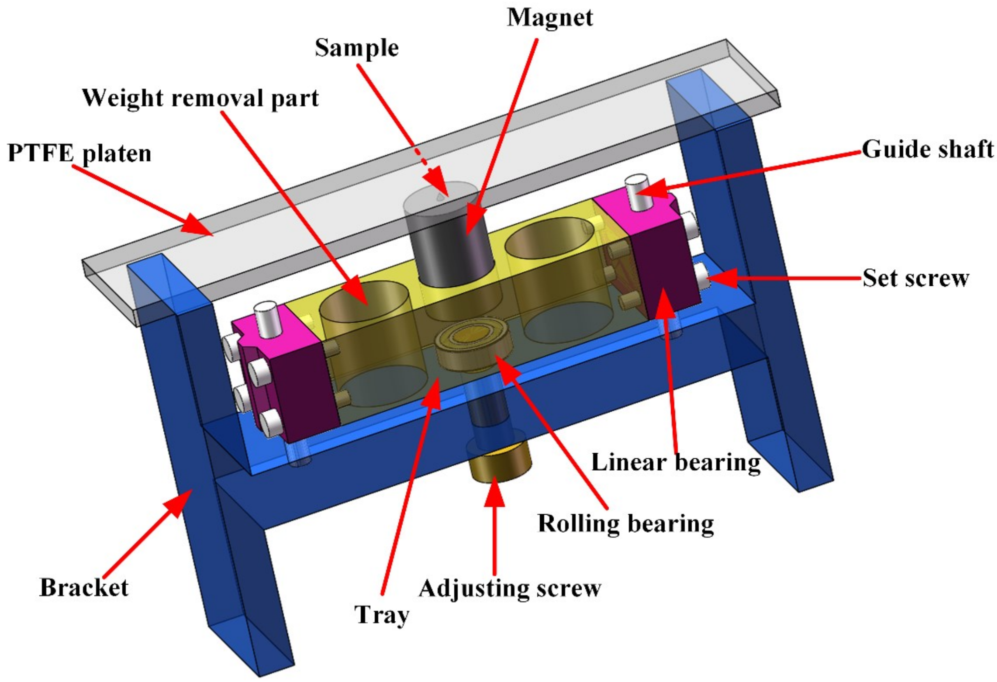

Fig. S1. The device for preparation of micropillars with flat terminals.

Forming rules of diameter and area density parameters of micropillars

As shown in Fig.S2, the diameter and area density of the of micropillars will change with *d*. When the *d* exceeds 1 mm, both the diameter and area density increase slowly, and the larger diameter is accompanied by mutual adhesion between micropillars, which has a negative impact on the adhesive force.

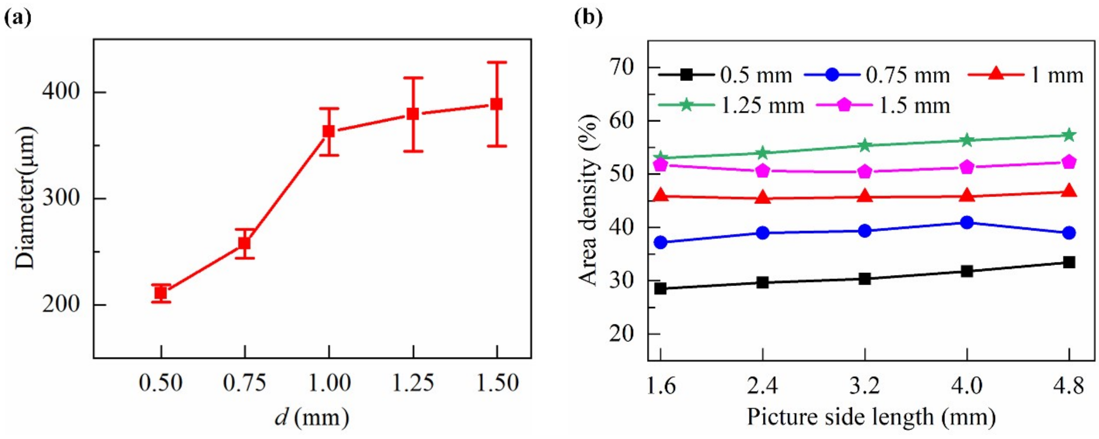

Fig. S2. (a) Diameter and (b) area density of the micropillar arrays with flat terminals.

The influence of pressed distance *d* on surface morphology

Observation and analysis of the top morphology of micropillars were performed using a ultraclear microscopic imaging system, as shown in Fig. S3, the photograph was taken at a magnification of 150 times, with an exposure time of 1/5, and 10 images were stacked and synthesized. From Fig. S3, it can be seen that when value of *d* is 0.5mm, although most of the pointed terminals have been compressed into flat terminals, there is still a small part that has not been compressed. As *d* increases, all pointed terminals are gradually compressed into flat terminals. When the value of *d* is 1mm, the formed flat terminals have a larger and more uniform top diameter. After the value of *d* exceeds 1mm, the micropillars begin to stick to each other, where the PTFE plate is close to the bottom of the micropillars, and their interspaces are too small. Under the effects of compression and diffusion, they are in contact and bond with each other.

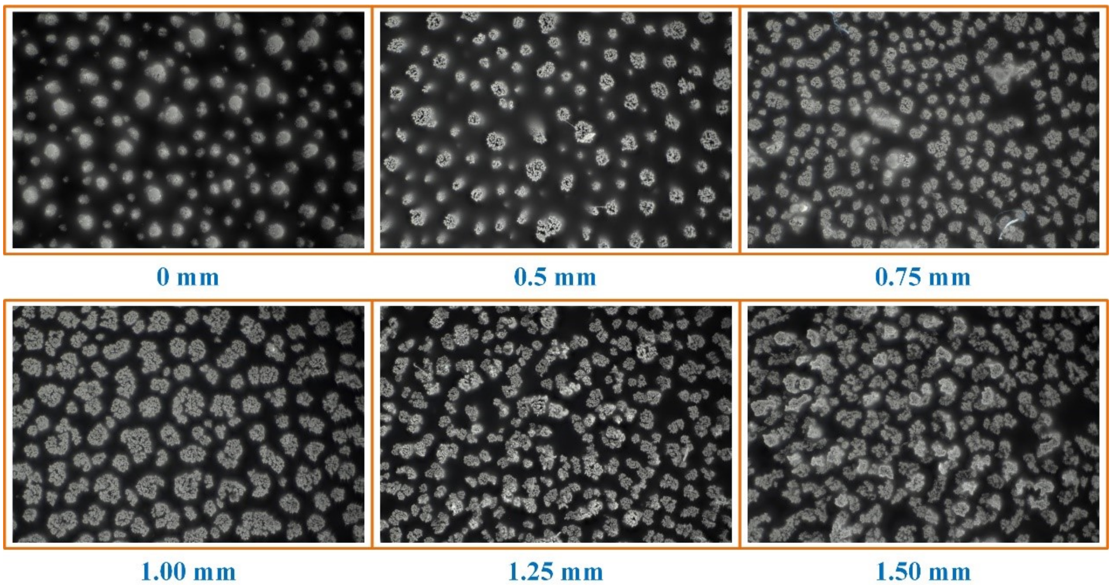

Fig. S3. Micromorphology of micropillars under different *d*.

Image processing

Fig. S4 depicts the image processing. As shown in Fig. S4a, we segmented the image with square side lengths of 1.6, 2.4, 3.2, 4.0, and 4.8 mm for image processing and statistically analyzed the microstructure distribution of samples near the central area. As shown in Fig. S4b, the image binarization analysis process consisted of fuzzification (converting the picture into a grayscale image), binarization (converting the grayscale image into a binary image, threshold = 125), and analysis (extracting histogram information from the image), which were all conducted using MATLAB software.

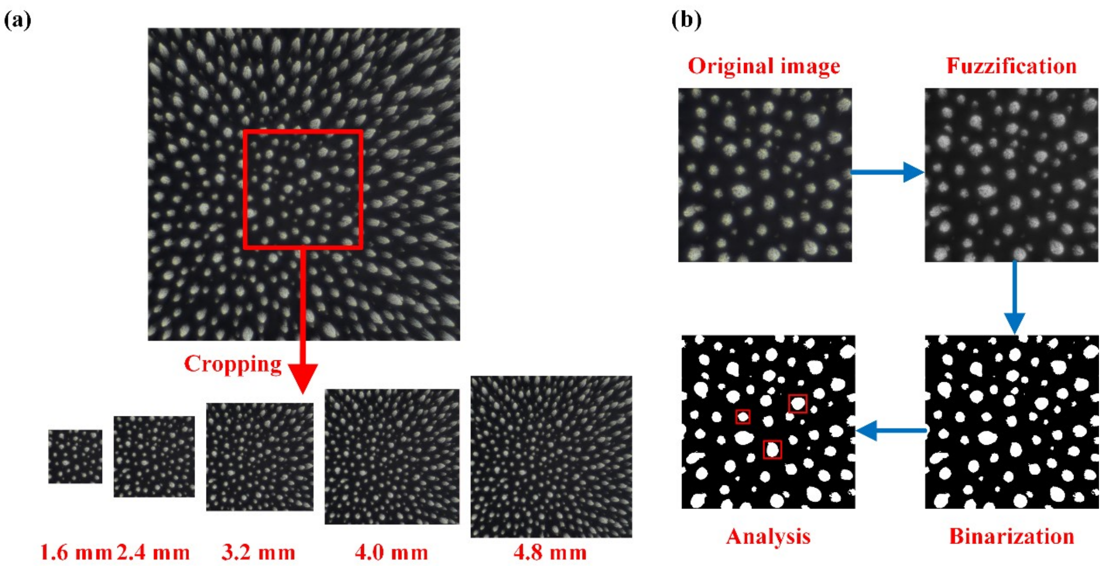

Fig. S4. Processes of image processing: (a) Image preprocessing; (b) Image postprocessing.

Transportation of various micro components

As shown in Fig.S5, the magnetically controlled transportation of various micro components with different materials, shapes and weights can be realized by wet adhesion.

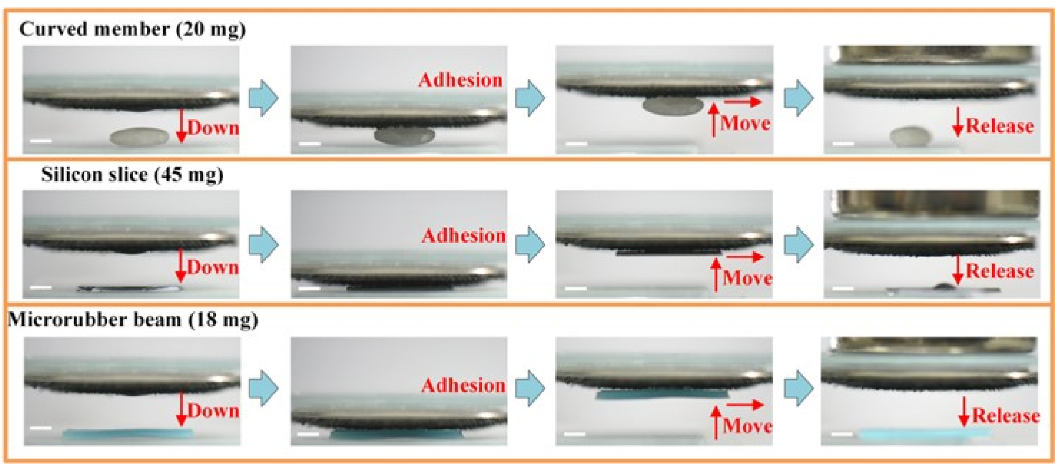

Fig. S5. Magnetically controlled transport of various micro components. scale bar: 2mm.