Supplementary Information for

Asymmetric microfiber actuators with reciprocal deformation

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Table S1. Comparisons of various microactuators.

Energy source	**Type**	**Advantages**	**Disadvantages**
Hygroscopic	Asymmetric microfiber actuators (this work)	Low-cost, easy-to-obtain, and biocompatible materials; Mass production; Reciprocal deformation.	Relatively slow response and low actuation force; Limited reliability.
Optical	Microribbons[1]	Continuous twisting.	Requiring continuous driving of the optical source.
	Resonant-opto-thermomechanical oscillator[2]	Driven by low optical power	Requiring continuous driving of the optical source; Displacement not large enough.
	Structural color actuators[3]	Reversible asymmetric shape deformations combined with structural color changes.	Requiring continuous driving of the optical source; Decrease or elimination of deformation with increasing temperature.
Electrical	Multiresponsive microactuator[4]	Directional locomotion; Maintaining functionality after heavy impact; Excellent movement adaptability.	Requiring continuous driving of the optical/electrical source; Motion speed strongly correlated with laser frequency.
	Electric stimulus-responsive microactuator[5]	A simple structural design for achieving a large vibration amplitude on a millimetre scale.	Requiring plasmonic thermal energy generated by electrical stimulation; Motion discontinues after a single stimulus trigger.
	Bending actuator	Easy fabrication;	Requiring continuous

	based on aligned carbon nanotube/polymer composites[6]	Low voltage; Controllable motion.	driving of the voltage; Only one deformation direction.
Magnetic	Soft μbots based on Pickering emulsions stabilized by magnetic particles[7]	Higher traction compared to rigid counterparts; Translation on curved surfaces.	Requiring continuous driving of the magnetic source; Lower translation speed compared to rigid μbots; Requiring metal-free environments.
	Sequence-encoded colloidal origami microbot[8]	Directional motion, steering, and maneuvering.	Requiring external magnetic fields; Necessity of changing sequences to alter functionality.
	Polymer nanocomposite microactuators[9]	Performance independent of environment; Efficient cumulative release of drugs.	Requiring metal-free environments; Requiring a pulsatile release profile of the magnetic field.
Acoustic	Acoustically controlled helical microrobot[10]	Switchable directionality by simply tuning the acoustic frequency.	Performance easy to be affected; Low propulsion efficiency.
Chemical	Chemically powered microactuator[11]	Autonomous Energy source.	Requiring the calculation of the energy carried.

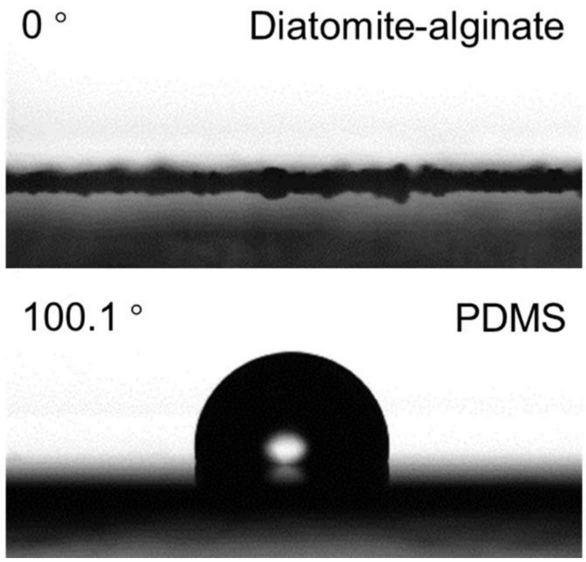

Fig. S1 Surface wettability of diatomite-alginate (superhydrophilic with a contact angle of 0°) and PDMS (hydrophobic with a contact angle of 100.1°).

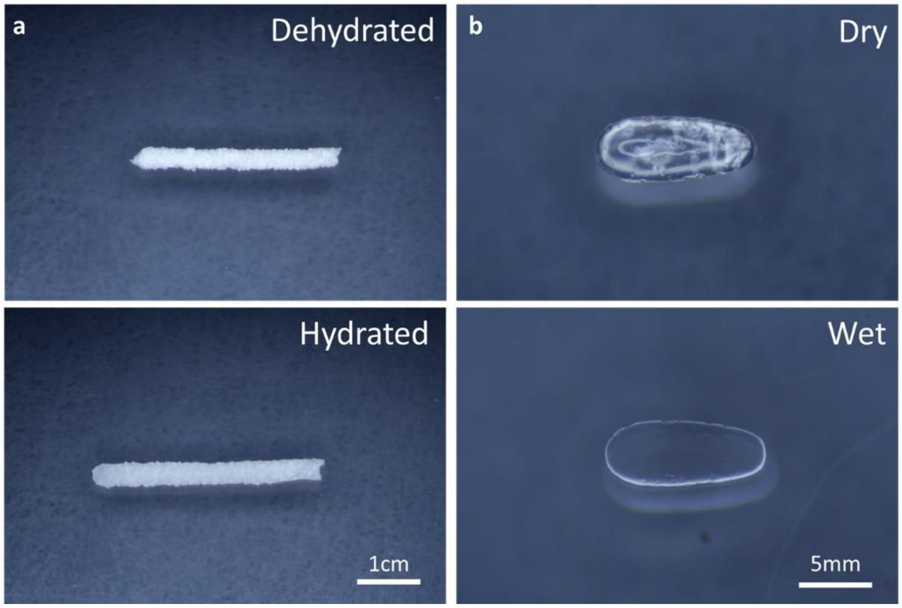

Fig. S2 Responses of (a) alginate-diatomite and (b) PDMS to humidity changes. Alginate-diatomite exhibits changes in volume in response to humidity variations, whereas PDMS does not.

Supplementary References

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