ADVANCED FUNCTIONAL MATERIALS

Supporting Information

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Directed Particle Transport via Reconfigurable Fiber Networks

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Supporting Information

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Supplementary Materials Section: All chemicals and lab supplies were obtained from VWR unless otherwise mentioned. Poly(acrylic) acid (PAA, Mw=450,000 g mol−1) and poly(methyl methacrylate) (PMMA, Mw=550,000 g mol−1) was purchased from Sigma Aldrich. Ethylene glycol (Emplura®, Merck Millipore, USA), Potassium dihydrogen phosphate (≥99.0% ACS, Fluka™, Honeywell Chemicals, USA), Sylgard 184 (PDMS, Dow Corning Corporation, USA), silicon wafers with a native oxide layer (Siegert Wafer GmbH, Germany), and Ballistol 25600 Teflon-Spray (PTFE, Conrad Electronic, Germany) were also used in the experiments.

Fiber Force Measurement: Silicon wafers were spray coated with polytetrafluoroethylene (PTFE) to ensure frictionless fiber force measurements. Once the bicompartmental fibers were jetted onto the wafers, a single poly(methyl methacrylate) (PMMA) fiber was jetted perpendicular to the bicompartmental fibers (**Figure S1**). The wafer was placed at a 5° angle to the microscope table. Similar to previous actuation experiments, the pre-filled chamber with the non-actuating pH 3.0 solution was replaced with pH 7.0. The actuated PAA fibers displaced the PMMA fiber with a known mass (**Equation 1**). With generated work from the bicompartmental fibers (**Equation 2**), the force can be calculated with **Equation 3**. The fiber surface area (**Equation 4**) is calculated to determine the drag force (**Equation 5**) on a curling fiber. The low drag force is neglected for the calculated force.

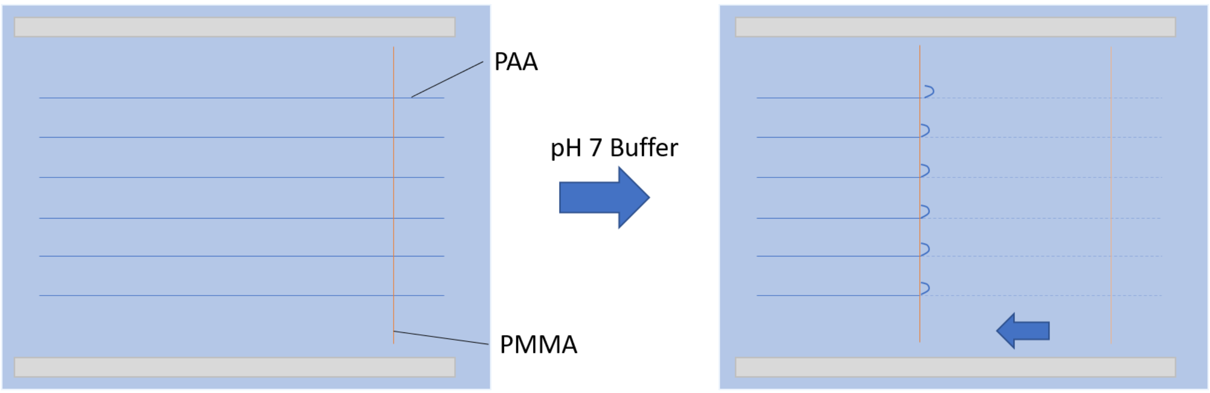


Figure S1. Schematic of fiber force measurement.

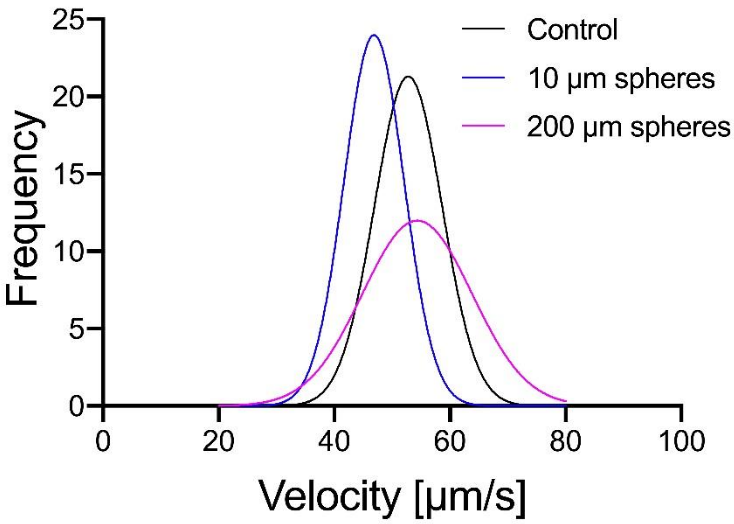
Mass of PMMA fiber:

$$m_{PMMA} = \pi * r^2 * l * \rho \tag{1}$$

With radius *r*, length *l* and ρ = 1.18 g/cm^3

PAA fiber work to displace PMMA fiber:

$$W = m_{PMMA} * g * h * \sin\alpha \quad (2)$$



With height h and g = 9.81 m/s^2

Force generated by one PAA fiber:

$$F = \frac{W}{\Delta x * n} \quad (3)$$

$$\boldsymbol{F = 3.4\ nN}$$

With distance x and number of PAA fibers n

Fiber surface area for drag force

$$A = \pi r h + \pi r^2 \quad (4)$$

With $r = 30 * 10^{-5}$ m and $h = 6 * 10^{-3}$m

Drag Force

$$F_D = \frac{1}{2} c_w * \rho * A * v^2 \quad (5)$$

$$\boldsymbol{F_D = 41\ pN}$$

With drag coefficient $c_w = 1.20$, $\rho = 997\ kg/m^3$, surface area A, velocity $v = 0.348 * 10^{-3}$m/s

	200 µm spheres	**10 µm spheres**	**Control**
Amplitude	11.98	23.98	21.30
Mean	54.34	46.87	52.79

Figure S2: Gaussian fitting of average fiber velocities. The velocity occurrence of each fiber is plotted against the velocity.

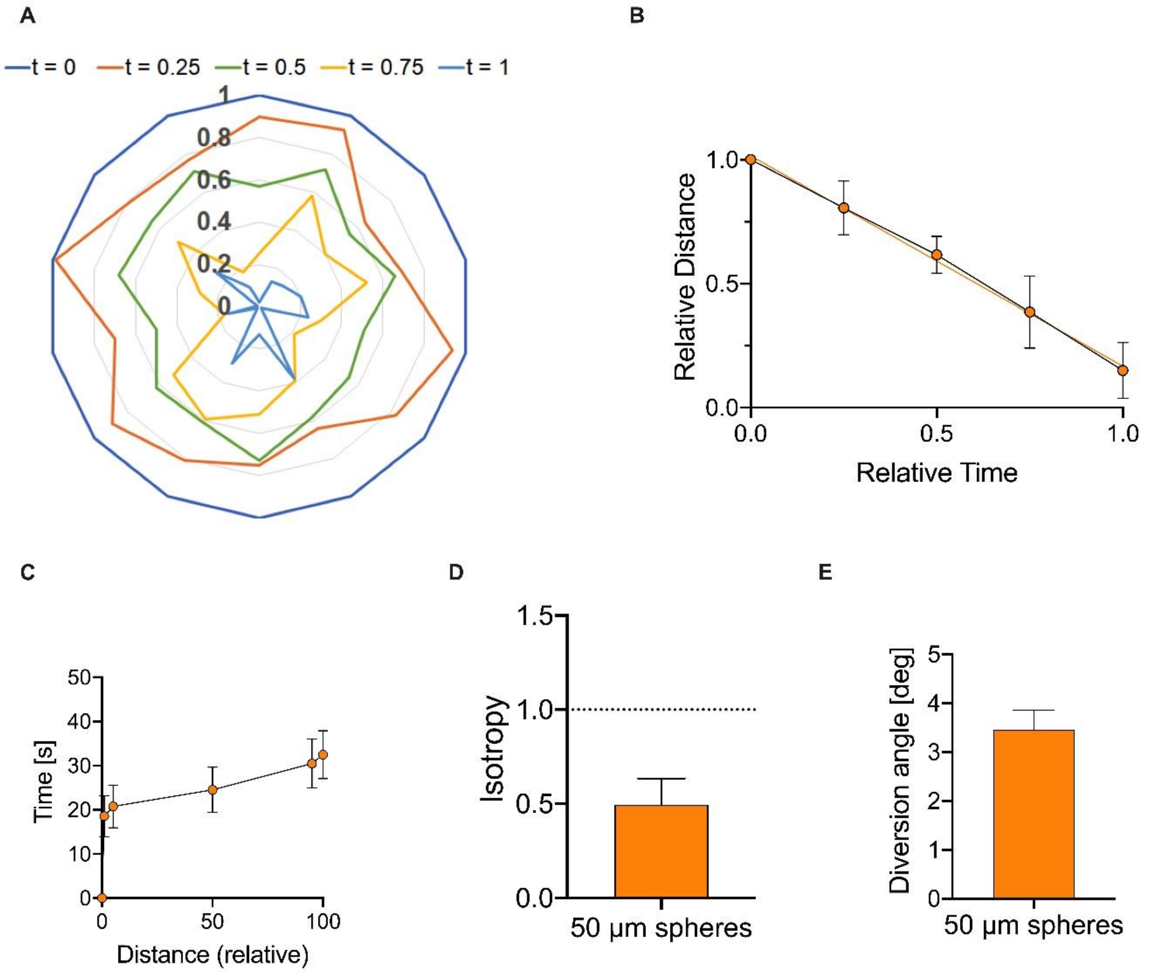


Figure S3: Particle transport of 50 µm spheres due to fiber reconfiguration. (A) Qualitative representation of relative surface area coverage over a relative time. **(B)** Quantitative representation of relative surface area coverage over a relative time. Trendline control

(y = -0.8486x + 1.0157; R^2 = 0.9973). **(C)** Actuation response of fibers. **(D)** Quantitative analysis of isotropy (n = 15 for all groups). Maximum isotropy value '1.0' indicating highly ordered fiber movements. **(I)** Quantitative analysis of diversion angle (n = 15 for all groups). Data in (B-E) are represented as mean ± s.e.m.

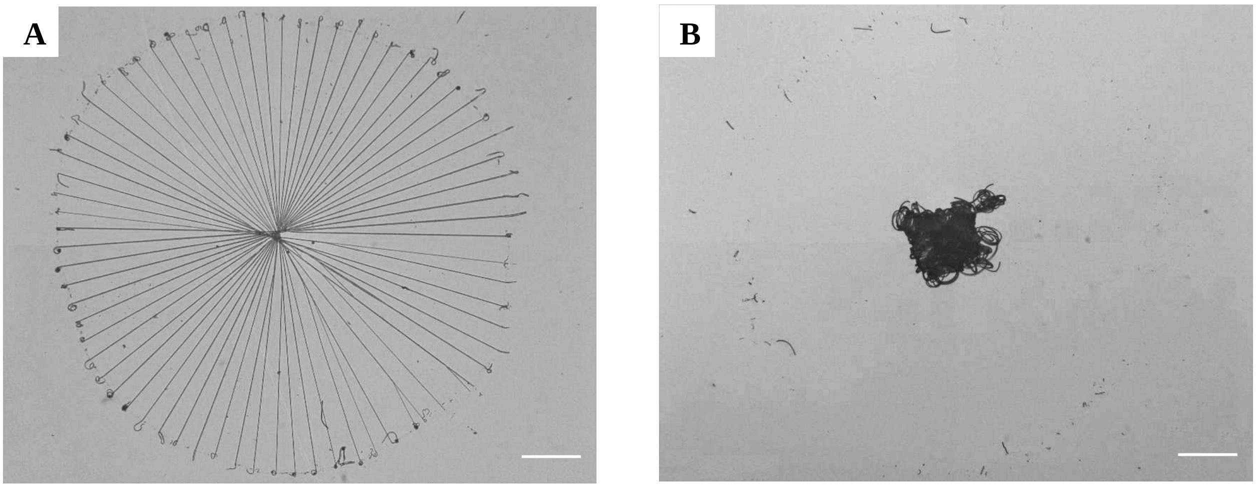


Figure S4. Fiber reconfigurability **(A)** before and **(B)** after the addition of 10% fetal bovine serum-based medium.

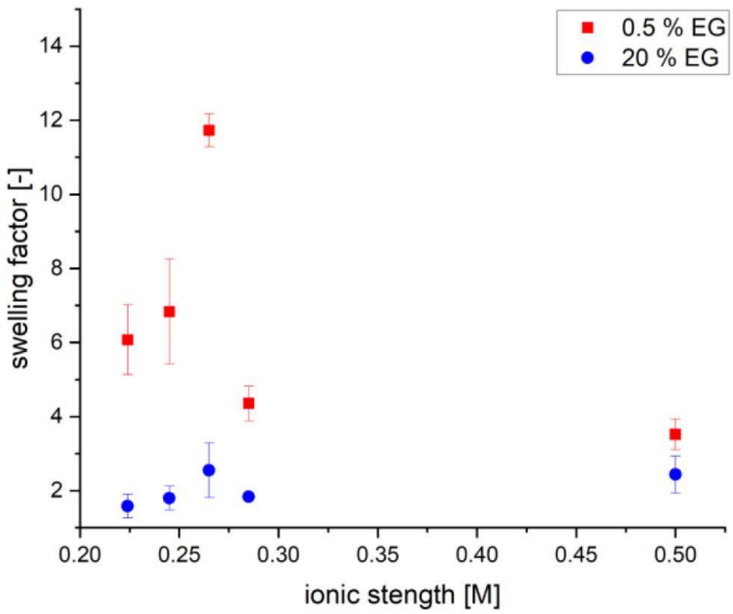


Figure S5. Swelling factor in dependence of the ionic strength of the actuating solution.