Electronic Supplementary Material (ESI) for Lab on a Chip.

Text for the video abstract

A continuous roll-pulling approach for the fabrication of magnetic artificial cilia with microfluidic pumping capability

Ye Wang, Jaap den Toonder, Ruth Cardinaels, Patrick Anderson
Eindhoven University of Technology

"Artificial cilia" are bio-inspired micro-actuators that can be used to generate liquid flow in microfluidic devices. We have developed a novel fabrication technique to make artificial cilia in a cost-effective and scalable manner.

On a glass substrate, we apply a thin film of liquid polymer containing magnetic microparticles. This substrate is place in a home-built apparatus on a moving stage. A roll, with a surface structure of micropillars, rolls over the moving substrate, and as the pillars touch the polymer film, tiny microfilaments are pulled out of the film. This process is enhanced by applying a magnetic field at the same time. Subsequently, the substrate is placed in an oven to cure the polymer so that it becomes elastic. A pre-made microfluidic device is attached on top of the artificial cilia substrate, so that we obtain a channel with the artificial cilia covering its floor. A liquid is injected into the microfluidic channel, and the device is placed on top of a rotating magnet apparatus. The rotating magnetic field makes the artificial cilia rotate within the liquid. As is shown by the motion tracer particles present in the liquid, this generates substantial liquid velocities.

In conclusion, this is a very promising cost-effective and scalable approach to create liquid flow in microfluidic applications such as point-of-care devices or lab on a chip.

For the full movie, see https://www.youtube.com/watch?v=Irj7Y86aJLU