Yoshida Lab.

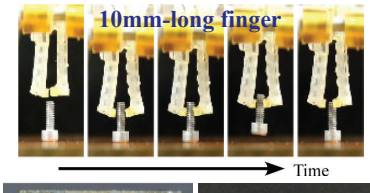
Innovative MEMS/Micro Systems Using Smart Materials

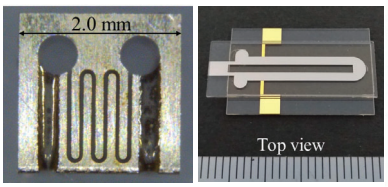
Innovative Mechano-Device Research Core, FIRST

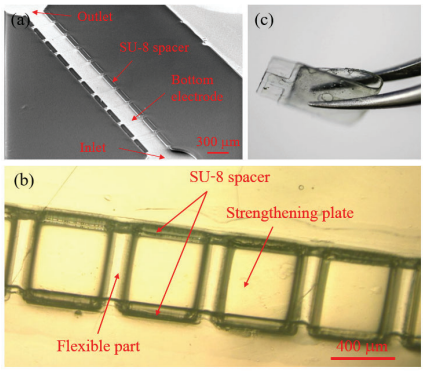
http://yoshida-www.pi.titech.ac.jp/

- New microactuators using functional fluids
- High-output power micro fluid power sources
- Advanced microrobots using fluid power

For advanced microrobots that perform power-needed tasks in micro areas, we have been developing innovative MEMS/ micro systems using smart materials such as an ERF (electro-rheological fluid) that changes its viscosity by an applied electric field. Microactuators, microvalves, micro fluid power sources, and micro-robots have been developed by using MEMS technologies.

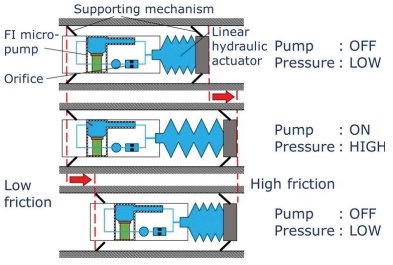


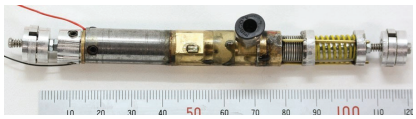




ER microvalves installable in soft microactuators

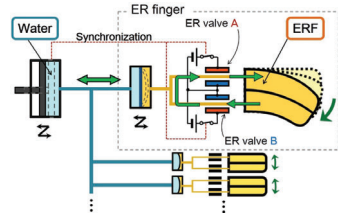
- Flexible ER microvalve (FERV) using conductive polymer was realized by MEMS process.
- 2×2×1.5mm^3-sized stacked ER microvalve was realized.
- High pressure ER microvalve was developed using MEMS technologies.

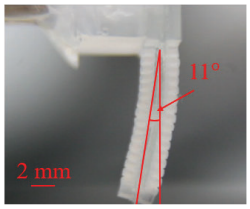


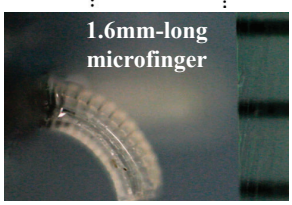


In-pipe mobile microrobot using FI micropump

- 12mm-dia. robot travels with on/off controlled FI micropump
- Traveling velocity of 0.9 mm/s was realized.

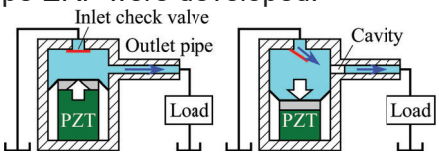


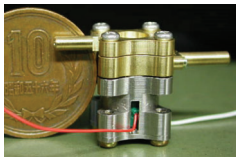




Multiple ER microfinger system using alternating pressure source

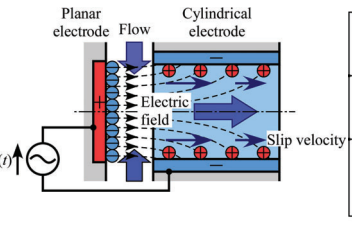
- Each microfinger is driven by synchronously rectifying ERF alternating flow using ER microvalves.
- 1.6mm-long microfinger was realized by MEMS process.
- Microfinger using FERVs and microfinger using particle type ERF were developed.

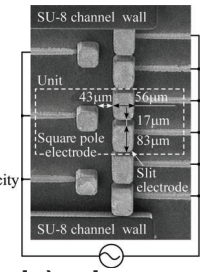


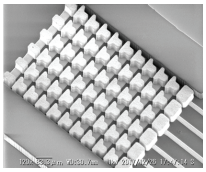


FI micropump

- Flow rate was increased by using fluid inertia (FI).
- Output power of 1.6 W was realized with 1.3cm^3-sized micropump.







ACEO (ac electroosmosis) micropump

- ACEO is generated by square pole and slit electrodes.
- Flow velocity of 1.6 mm/s was realized with 0.2×0.2×0.05mm^3-sized micropump.