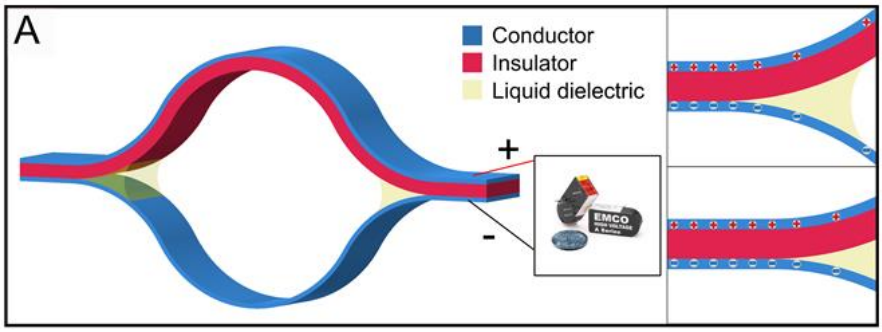
Collaboration/Licensing Opportunity

University of BRISTOL
Research and Enterprise Development

Dielectrophoretic liquid zipping actuators

High speed and high efficiency contractile actuation can be achieved with novel electrostatic actuators.



Actuators are physical devices which exert force or do work, such as pistons, motors and muscles. Traditional pneumatic, hydraulic or electromagnetic actuators typically shorten by up to 50%.

The novel technology is a dielectrophoretic liquid zipping actuator which involves a high permittivity insulating layer, conductor layers and a liquid dielectric (e.g. silicone, mineral or even vegetable oil) applied as a bead at the zipping locus. The conductor and insulator can be made from any material. This design allows for high speed, high efficiency and scalable contractile actuation, capable of contractile strains of 99.8%, greater than any actuation concept to date, and can lift over 1000 times their own weight. The thinness of these actuators when fully contracted allows them to shorten to a minimal thickness.

This actuation technology can be applied in a wide range of morphologies for operation in linear and torsional applications. Designs are versatile, and could be complex actuated origami structures, paper and 3D printed actuators, self-spiralling ribbon actuators, tensile elements inspired by spider silk or artificial muscles.

Key Benefits

- Can lift 1000 times their own weight
- Can shorten by over 99%
- Actuation frequencies up to 10 Hz
- Power to weight ratio of 51-103 W/kg (for comparison, human muscle is typical 50 W/kg)
- Actuation over 100,000 cycles with negligible variation in stroke
- Silent operation
- High energy efficiency (~70%)
- Can be 3D printed
- Can be made from any combination of conducting and insulating materials, including paper and pencil

Applications

- Pistons, motors, pumps, gates, valves, adaptive grippers or other motion devices
- Artificial muscles in haptics and robotics (e.g. origami artificial muscle)
- Self-packing structures (e.g. as a concept for self-packing solar panels)

IP Status

UK and international patent applications pending.

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