**OBJECTIVE**
To design lightweight, resilient, inexpensive and recyclable electroactive polymers as replacements for traditional metal/ceramic-based, mechanical (hydraulic and pneumatic) actuators.

**PROBLEM**
Existing high-performance electroactive polymers, classified as dielectric elastomers, derive from cross-linked homopolymers, which afford little versatility in terms of property development.

**SOLUTION**
Network-forming triblock copolymers selectively swollen with a low-volatility solvent constitute a new and broad platform for the rational design of highly tunable dielectric elastomers.

**IMPACT**
Commercial triblock copolymer thermoplastic elastomers possess excellent (electro)mechanical properties, including shape memory, that can easily extend to other technologies.

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**Background**

**Classes of EAPs**

- Dielectric elastomers possess natural muscle-like mechanical properties
- Dielectric polymers - high electric field for action
- Piezoelectric materials - very low actuation strain

**Limitations**

- Compliant electrodes cause transverse squeezing of elastomer due to Maxwell stress
- Interactions due to volume exclusion

**Electroactive response**

- Extent of electroactuation and dielectric breakdown are composition-tunable.
- Copolymer-based dielectric elastomers outperform conventional materials and resemble the behavior of jellyfish.

**Electromechanical characterization**

- Stress-strain curves from electroactuation resemble those from mechanical compression.
- The electromechanical modulus (Y_e) is introduced as a new property metric.

**Morphology of biaxially stretched films**

- X-rays scattered by PS endblocks giving shape, size and arrangement of PS domains
- Scattered image is Fourier transform of real structure

**Conclusions**

- Dielectric elastomers derived from selectively solvated triblock copolymers exhibit high actuation strains at relatively low fields, and are extremely versatile.
- Actuation can be more systematically characterized by the electromechanical modulus.
- Micelles remain intact but interact differently when the solvated copolymer networks are bi-axially strained.
- Mechanical properties can be effectively mediated by co-solvency.

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