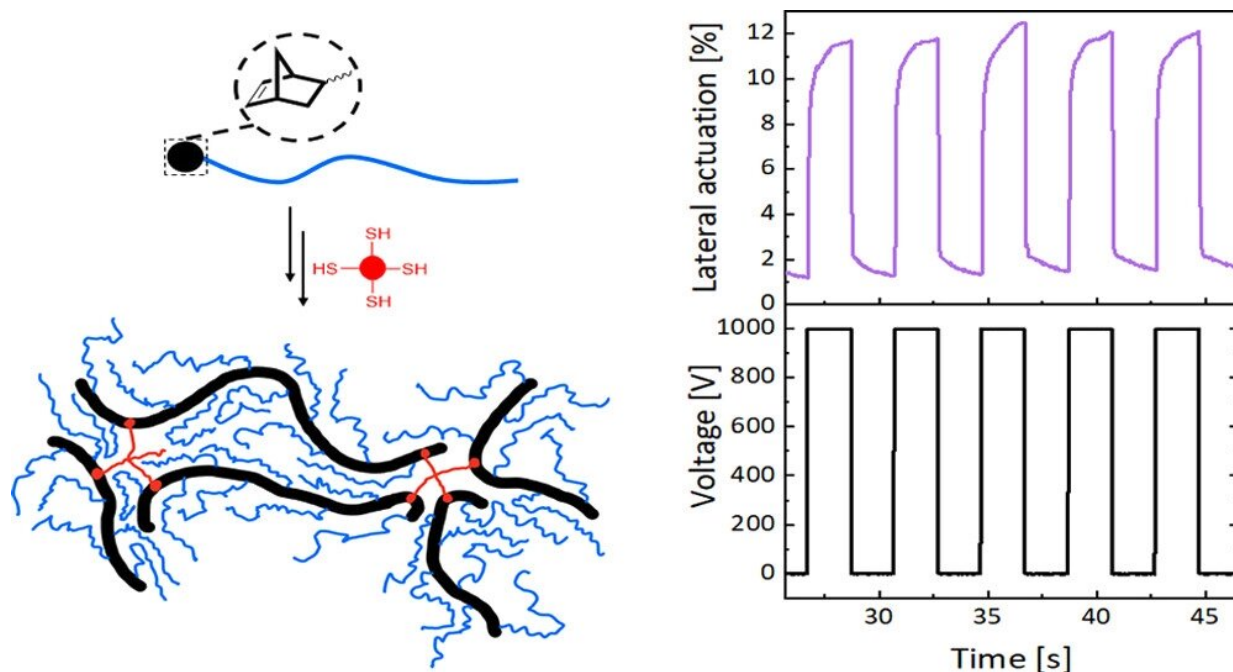


# Toward a safer material for artificial muscles

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Graphical abstract. Credit: *ACS Applied Materials & Interfaces* (2023). DOI: 10.1021/acsami.2c23026

Whether wriggling your toes or lifting groceries, muscles in your body smoothly expand and contract. Some polymers can do the same thing—acting like artificial muscles—but only when stimulated by dangerously high voltages. Now, researchers in *ACS Applied Materials & Interfaces* report a series of thin, elastic films that respond to substantially lower electrical charges. The materials represent a step toward artificial muscles that could someday operate safely in medical

devices.

Artificial muscles could become key components of movable soft robotic implants and functional artificial organs. Electroactive elastomers, such as bottlebrush polymers, are attractive materials for this purpose because they start soft but stiffen when stretched. And they can change shape when electrically charged. However, currently available bottlebrush [polymer](#) films only move at voltages more than 4,000 V, which exceeds the 50 V maximum that the U.S. Occupational Safety & Health Administration states is safe.

Reducing the thickness of these films to less than 100  $\mu\text{m}$  could lower the required voltages, but this hasn't been done successfully yet for bottlebrush polymers. So, Dorina Opris and colleagues wanted to find a simple way to produce thinner films.

The researchers synthesized a suite of bottlebrush polymers by reacting norbornene-grafted polydimethylsiloxane macromonomers and cross-linking the products by [ultraviolet light](#). A 60- $\mu\text{m}$ -thick material was the most electroactive, expanding more than previously reported elastomers, with an operating voltage of 1,000 V. And a circular actuator made out of that material expanded and contracted more than 10,000 times before degrading.

In another set of experiments, the researchers introduced polar side chains to the polymers and produced [materials](#) that responded to voltages as low as 800 V. However, they didn't expand as much as the team's most electroactive film. Based on the results, the researchers say that, with some tweaks, the material could someday be used to develop durable implants and other [medical devices](#) that work at safer voltages.

**More information:** Yeerlan Adeli et al, On-Demand Cross-Linkable Bottlebrush Polymers for Voltage-Driven Artificial Muscles, ACS

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