Electro-Actuator Polymers Exhibiting Giant Strain Coefficient and Polymer Devices Containing Such Polymers

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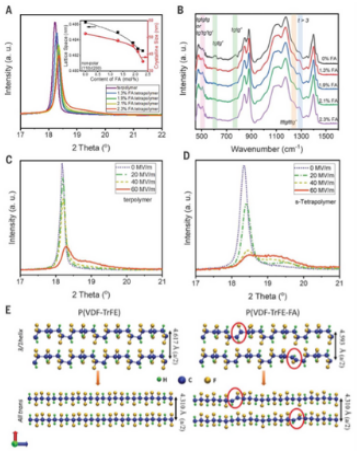

Structural analysis of P(VDF-TrFE-CFE-FA) relaxor polymers

Technology Summary

This invention represents a new class of modified PVDF polymers that generate large actuation strain and large strain coefficient while maintaining the elastic modulus > 0.15 GPa. The polymeric material generates large actuation strength of ΔS/ΔE> 750 pm/V at electric fields below 60 MV/m. The researchers have demonstrated these effects under different applied electric fields (from 30 MV/m to 70 MV/m) and formulations. A scholarly article describing the invention was published in Science (Chen, et al.; Vol. 375, pages 1418-1422; March 25, 2022) along with a third-party commentary.

Application & Market Utility

Polyvinylidene difluoride and its copolymers are the most widely used piezoelectric polymers in the market for transducers, sensors, actuators, soft robots, artificial muscles, and wearable devices. However, many of these applications require larger electromechanical actuation strain than the polymers can currently provide. While certain high-strain PVDF-based materials exist, they suffer from electric breakdown that limits the electric field, as a higher field will result in device failure. Due to dielectric breakdown, larger films have a much lower breakdown field tolerance (<60 MV/m).

Next Steps

Commercially viable devices require a large actuation response under low electric fields. The lead inventor continues to conduct research by collaborating with international polymer manufacturers.

TECHNOLOGY READINESS LEVEL 4

Seeking

Licensing | Research

Keywords

- Electro-active polymers
- Actuators
- Artificial muscles
- Transducers

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