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Electric Poling Additive Manufacturing of Piezoelectric Poly(vinylidene fluoride)-based Functional Materials

Electrically poled PVDF structures with 8× improved piezoelectric response for sensing applications.

Researchers at Purdue University have developed a new method for additive manufacturing (3-D printing) of functional materials. No methods that combine additive manufacturing and electric poling currently exist, significantly limiting the range of materials that can be electrically polarized. The Purdue researchers' method allows for electric poling of complex geometric structures. The Purdue researchers electrically polarized poly(vinylidene fluoride), known as PVdF, to improve its characteristics and performance, including its piezoelectric activity, sensitivity, and beta-phase. The highest average piezoelectric activity obtained using the researchers' method was 59.2 pC/N, whereas the average piezoelectric activity of printed unpoled films was 7.13 pC/N.

Advantages

- Allows functionalizing complex 3D structures

- Allows for embedding sensing into 3D structures

- Improves piezoelectric response

Applications

- Piezoelectric force and temperature sensing

Technology Validation: Increasing the poling voltages and time provided a piezoelectric activity approximately 8 times higher than that of unpoled films.

Publications

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Authors
Jinsheng Fan
Jose Manuel Garcia Bravo
Robert A Nawrocki
Brittany A Newell

Further information
Patrick Finnerty
pwfinnerty@prf.org

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1] https://doi.org/10.1002/adem.202200485

2] https://doi.org/10.1115/SMASIS2021-67832

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