

## Non-Confidential Description - PSU No. 3187 "Chain End Functionalized Semicrystalline Ferroelectric Fluoropolymers for Electromechanical Applications"

### Keywords:

Ferroelectrics, actuators, transducers,  
 fluoropolymers, ferroelectric

### Patents & Links:

[US Patent 7,842,390](#)

[Inventor Website](#)

### Inventors:

T.C. ("Mike") Chung, Atitsa Petchsuk

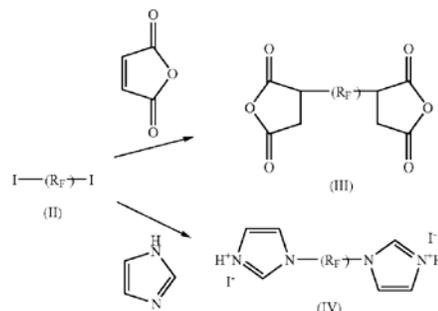


Figure 1. Conversion of terminal iodo groups in the fluoropolymer

### Background

Ferroelectric materials that generate mechanical actuation induced by external electric field have attracted a great deal of attention and have been recognized for applications in a variety of transducers, actuators and sensors. Most of the current commercial applications for ferroelectric materials are based on piezoceramics and magnetostrictive materials, despite the fact that they exhibit many deficiencies, such as low strain levels, brittleness, heavy weight, high processing temperatures and processing difficulties when producing parts having complicated shapes. In sharp contrast, ferroelectric polymers exhibit many desirable properties, such as flexibility, light weight, high mechanical strength, an ability to be processed readily into large area films, and an ability to be molded readily into a variety of configurations. Despite these advantages, most ferroelectric polymers suffer the disadvantage of having low electric field sensitivity, in terms of dielectric constant, piezoelectric coefficient, electromechanical coupling coefficient and field induced strain, which limit their applications.

### Invention Description

The present invention relates to chain end functionalized fluoropolymers that may exhibit good chemical reactivity, such as for crosslinking reaction and composite preparation, high breakdown electric field  $E > 100$  MV/m (megavolts per meter), high dielectric constant ( $E: > 10$ ), and high energy density. More particularly, the invention relates to fluoropolymers made from vinylidene difluoride (VDF) with one or more additional monomers, such as trifluoroethylene (TrFE), tetrafluoroethylene (TFE), chlorotrifluoroethylene (CTFE), chlorodifluoroethylene (CDFE), chlorofluoroethylene (CFE), hexafluoropropene (HFP), etc. which can be prepared by functional initiators. The resulting chain end functionalized fluoropolymers can advantageously have high dielectric and ferroelectric properties as well as good chemical reactivity.

### Advantages/Applications

- High dielectric constant, high field sensitivity, high energy density
- Robotic performance for a long period of time with large electromechanical response and ultrahigh energy density under high electric field.

Contact: Bradley A. Swope  
 Sr. Technology Licensing Officer  
 The Pennsylvania State University

Phone: (814) 863-5987  
 Fax: (814) 865-3591  
 E-mail: [bradswope@psu.edu](mailto:bradswope@psu.edu)

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