PVDF-based sensing component: Effects of molecular weight and uniaxial stretching on electro-mechanical capability

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ABSTRACT

Poly (vinylidene fluoride) (PVDF) is a piezoelectric material owing to desirable properties to serve as an efficient sensing component to mechanical stimulation. Being a polymorph of several structural phases (α, β, γ, δ, and ε), the electro-active β-phase is of importance to achieve high sensing capability. The inducing the β-phase can be performed via different routes including the incorporation of variety of nanomaterials and/or poling in external electric fields. The enhancements in the piezo-activity can be also done through a simple uniaxial stretching. In this study, the PVDF sheets differing in the molecular weights were stretched at the elevated temperature to various elongations. The correlation between their molecular and processing parameters was investigated using the FTIR and XRD analyzes. After the stretching, the enhanced piezoelectric β-phase content was found due to aligned structure of the electro-active crystallites. The electro-mechanical capability was analyzed via investigation of d33 coefficient by Berlincourt method. The obtained data may be used in the optimization of the PVDF processing parameters in order to tailor the PVDF materials of high sensing capability serving as the sensing component exploiting the mechanical energy to electrical signal.

Keywords: crystallites; piezoactivity; polymorphism; power generator; stretching

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