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# A new approach to fabricate poly(vinylidene fluoride-trifluoroethylene) fibers using a torsion-stretching method and characterization of their piezoelectric properties

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## ABSTRACT

A new, simple, and economical approach to fabricate P(VDF-TrFE) fibers using a torsion-stretching method is introduced. The average Young's modulus, strength, and nominal strain of the fibers were 902MPa, 258.56MPa, and 35.23%, respectively. Three conventional treatments (mechanical stretching, electrical poling, and annealing-cooling) were conducted to enhance the $\beta$-phase of the P(VDF-TrFE) fibers. All these treatments were effective in enhancing the crystallinity of the $\beta$-phase of the fibers. The maximum $\beta$-phase fraction (66.78%) was obtained from annealing-cooling, while the control group exhibited a $\beta$-phase fraction of only 48.29%. Furthermore, using a carbon-epoxy composite laminate an electro-mechanical test was conducted to estimate the piezoelectric performance of the P(VDF-TrFE) fibers for assessing the relationship between the generated voltage and the compressive force. The maximum generated voltage from the fiber-type sensors treated by annealing-cooling was 0.14 V, which had the highest relative $\beta$ fraction among the three treatments.

**Keywords**: A. Smart materials; A. Polymer (textile) fibre; B. Impact behaviour; D. Mechanical testing.

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