Contribution ID: **113** Type: **Poster Only**

Electrospun Multiferroic Nanocomposites: PVDF-TrFE Fibers Doped with Iron Oxide Nanoparticles.

Multifunctional polymer nanocomposites are increasingly being explored for next-generation flexible electronics and smart sensing and energy harvesting applications. In this study, we report the fabrication and morphological optimization of electrospun nanofibers based on the ferroelectric copolymer poly(vinylidene fluoride–trifluoroethylene) (PVDF-TrFE), doped with magnetic iron oxide (Fe_3O_4) nanoparticles. The goal is to develop multifunctional systems exhibiting both piezoelectric and magnetic properties, paving the way toward magnetoelectric coupling in flexible platforms. A series of experiments were conducted using PVDF-TrFE solutions (80:20 molar ratio) in an acetone:DMF solvent system, with Fe_3O_4 introduced in both powdered and colloidal forms. Challenges such as nanoparticle agglomeration and solvent incompatibility (especially with toluene-based colloids) were addressed through probe sonication and viscosity tuning via polymer concentration adjustments (10–18 wt%). The influence of electrospinning parameters—voltage (10–25 kV), flow rate, needle-to-collector distance, and needle gauge—on fiber morphology was systematically evaluated using scanning and transmission electron microscopy (SEM/TEM). Energy dispersive X-ray spectroscopy (EDS) confirmed the presence of Fe_3O_4, although dispersion remained non-uniform. Our findings show that nanoparticle doping significantly affects fiber morphology and enhances the piezoelectric response by increasing the electrical conductivity of the spinning solution. Optimized conditions yielded uniform, bead-free fibers with reduced diameters. Despite partial success in achieving nanoparticle dispersion, evidence of magnetoelectric coupling remains to be established. This work contributes to the growing body of multiferroic material research aimed at integrating electrical and magnetic functionalities in polymer nanofibers for emerging applications in wearable devices, energy harvesting, soft robotics, and adaptive sensing.
This work is supported by the U.S. Department of Energy, Office of Science, under award number DE-SC0025748 grant.

Topical Area

Soft matter: polymers, and complex fluids

Author: ADJEI - YEBOAH, Joshua (TIGER Institute, Tennessee State University, Nashville TN 37209)

Co-authors: Dr UEDA, Akira (Department of Life and Physical Sciences, Fisk University, Nashville TN 37208); Dr HOFFMANN, Axel (Illinois Materials Research Science and Engineering Center, University of Illinois at Urbana-Champaign, Urbana, IL 61801); Dr TUZ ZAHRA, Fatima (TIGER Institute, Tennessee State University, Nashville TN 37209); Dr ZHU, Lei (TIGER Institute, Tennessee State University, Nashville TN 37209); Dr MU, Richard (TIGER Institute, Tennessee State University, Nashville TN 37209)

Presenter: ADJEI - YEBOAH, Joshua (TIGER Institute, Tennessee State University, Nashville TN 37209)