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Fabrication of multiferroic polymeric fibers – a platform for sensory application

Multiferroic materials represent a novel class of material where multiple types of ferroic ordering coexist. The co-existence of the multiferroic coupling can lead to additional ordering parameters. These, in turn, can be leveraged to form new multifunctional devices. The ferroic orderings in general are ferroelectric, ferromagnetic, and ferroelastic. These materials can exhibit a spontaneous polarization, magnetization or strain, which can be further controlled by an applied electric, magnetic, or stress field, respectively. In a multiferroic, when multiple types of ferroic ordering are coupled, additional functionalities can arise, including magnetoelectric, piezoelectric and magnetoelastic behaviors. However, we are interested in magnetoelectric multiferroics that combine ferroelectricity with ferromagnetism.

Fabrication and production of desired polymeric nanofibers requires multidisciplinary knowledge and engineering design and optimization. In my research, I will primarily use PVDF and its copolymer as the piezoelectric host materials. Magnetic nanostructures – particles and/or rods will be introduced as “additives/dopants” to achieve multiferroicity. I will first to develop fabrication parameters from which the highly controlled polymeric fiber can be produced and characterized. Then prototype sensors will be developed including energy harvesting and mass sensing devices will be fabricated and tested.