DREXEL UNIVERSITY
Materials Science and Engineering
College of Engineering

Fiber-based Resistive Strain Sensors for Wearable Applications

PhD Candidacy Exam

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Abstract

The demand for flexible and wearable sensors that can be comfortably worn and can sense a wide range of body movements is growing. The potential applications of wearable strain sensors include personalized health-monitoring, human motion detection, human-machine interfaces, and soft robotics. Conventional strain sensors are typically fabricated from rigid materials, such as metal or semiconductors, therefore they result in bulky, inflexible, and hard-to-wear devices and can only withstand small strains. On the other hand, wearable strain sensors combine strain sensing functionality with high stretchability. Since fibers are fundamental structures that make up textiles, fiber-based strain sensors will be the focus of this talk, which will discuss separately the effect of the sensing components (*e.g.,* conductive polymers, carbon nanomaterials, metal nanoparticles and nanowires) and the possible performance enhancements coming from the yarn and the fabric structure. The sensing mechanisms of fiber-based strain sensors will be explained with the emphasis on the resistive type sensors, because they are more commonly used in textile applications due to their facile fabrication and ease of incorporation. The important performance factors including electrical conductivity, mechanical properties, sensitivity, sensing range, and stability and their effects on the sensing performance of fiber-based strain sensors will be discussed. The critical evaluation of the relevant knowledge gaps and research opportunities that may help to shape the future developments of truly wearable textile sensors will be presented.