Capitol Graduate Research Summit

# ULTRASONIC GUIDED ELECTROSPUN CONDUCTIVE NANOFIBERS FOR BIOENGINEERING AND ADVANCED MANUFACTURING

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Electrospinning is an effective method to produce nanoscale fibers used in biomedical devices, filters, water treatment, electronics, and composites. Current technology cannot effectively control the trajectory and spin of fibers as they are formed between the polymer source and collection plate. Moreover, the fibers spun must be non-conductive, which severely limits the number of potential applications. This research focused on overcoming these limitations and developing an innovative approach to the fabrication of conductive nanofibers through the integration of electrospinning and novel ultrasonic phased arrays. A phased array of ultrasonic transducers produces acoustic holograms to precisely guide electrospun fibers toward the collection plate. A prototype ultrasonic assisted electrospinning device has been assembled and tested. The device guided fibers by acoustic forces and deposited them in specified locations on the collection plate. Ongoing research involves the introduction of higher frequency transducers, larger acoustic arrays with various geometries, and innovative collection plate designs. Test results have laid the foundation for future work, with a clear trajectory toward creating multifunctional conductive nanofibers. This work represents a significant advancement in nanofiber fabrication techniques, opening avenues for continued research and innovation into tissue engineering and sensors for biomedical applications, aircraft lightning protection and stealth, and terahertz antennas for 6G communication technologies.