ABSTRACT:

Strategic Integration of Electrospinning and Additive Processing for Harvesting Energy in IoTs

Ashok Vaseashta
1International Clean Water Institute, Manassas, VA USA.
2Institute of Electronic Engineering and Nanotechnologies "D. Ghitu" Academy of Sciences, Chisinau Moldova.

Advances in polymers and synthesis methods have been used to produce some new and unique devices and are reported in this presentation. One of the strategies is employing digitally controlled fabrication by combinatorial synthesis methods such as electrospinning and 3D printing/additive processing. Using synergistic integration of configurations, elaborate shapes, and patterns are printed with mesostructured stimuli-responsive electrospun membranes, allowing for in-plane modulations, and compensations due to internal interlayer stresses induced by swelling/shrinkage or mismatch, thus guiding shape morphing behaviors of electrospun membranes to adapt to environmental changes. Recent progress in combinatorial processing includes materials and scaffold constructs that are used for tactile and wearable sensors, filtration structures, sensors for structural health monitoring, biomedical scaffolds, tissue engineering, and optical patterning, among many other applications to support the vision of synthetically prepared smart material designs that mimic the structural aspects with digital precision. A novel technology called 3D jet writing was recently reported that propels electrospinning to adaptive technologies for the manufacturing of scaffolds according to user-defined specifications of the shape and size of both the pores and the overall geometric footprint. This presentation focuses on two specific applications, viz. energy and atmospheric water harvesting. Recent advances in next-generation triboelectric nanogenerators (TENG) along with the integration of finite-state machines (FSM) and built-in edge computing in onboard IoT devices have reduced the energy requirement, thus shifting the energy storage requirements to built-in power generation and ambient sources. The presentation describes the synergetic integration of exponential technologies in several examples that minimize energy storage and reduce energy consumption. Applications that include IoTs, IoB, and onboard energy harvesting devices include tactile sensing for biomedical applications, smart agriculture, and transportation logistics. A brief discussion of the concerns elaborating on privacy with IoT and IoB will be presented.

Keywords: Keywords: Harvesting, Energy, Transdisciplinarity, Exponential Technologies, 3D printing, Electrospinning, Sustainability